THE

FOUNDRY TRADE JOURNAL

WITH WHICH IS INCORPORATED

THE IRON AND STEEL TRADES JOURNAL.

VOL. 37. Thursday, August 11, 1927. No. 573.

PUBLISHED WEEKLY.

Subscription Terms: 15s. per annum.
Foreign and Colonial, 17s. 6d. per annum.
All Subscriptions are payable in advance.

All communications to be addressed to the Editor, or to the Publisher, as the case may be, of

THE FOUNDRY TRADE JOURNAL,
49, WELLINGTON STREET, LONDON, W.C.2.
Telephone: Gerrard 3951 (4 lines).
Telegraphic Address: "Zacatecas, Rand, London."

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THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES EQUIPMENT AND SUPPLIES ASSOCIATION.

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Nineteen Thirty-Seven.

It has recently been pointed out that mondial production of pig-iron has remained practically stationary during the last decade, and for this lack of progress two reasons have been assigned. Primarily it is truthfully stated that larger percentages of scrap are used for steel-making purposes, and, secondly, the replacement of iron castings by stampings and forgings. A third reason which we believe is equally important which has not been dealt with in contemporary reviews is the extensive use of steel scrap in cupola practice. The addition of steel has been gradually increasing in recent years until a 50 per cent. constitution of the charge is often exceeded Even in the baby Bessemer process for making steel castings hematite iron has been largely replaced by steel scrap. Britain's premier steel foundryman, Sir Robert Hadfield, in his presidential address to the Iron and Steel Institute in 1905, predicted that the world's output of pig-iron in 1926 would be 68 million tons, whereas actually it was about 76 million tons—a truly wonderful approximation. Quite recently our American contemporary has been making a ten-year forecast for iron and steel production. In 1926 the world production of steel was 89 million tons. Ten years' increase in American production is prophesied to yield an extra 12 million tons, that of Europe 14 million tons. Dr. J. H. Mathews, of the Crucible Steel Company, of America, criticising these figures, suggests that they may be seriously modified by the increased use of alloy and corrosion-resisting steels. We venture to suggest that the future output of pig-iron will likewise be modified by similar developments in the field of cast iron. Additionally, engineers are slowly realising that for cast iron, increased thickness of section does not necessarily or yet correspondingly insure greater strength. On the other side of the equation the serious improvements which have recently been effected in the mechanical properties of cast iron may augment the production of pig-iron (or will it merely make inroads on steel scrap?) at the expense of steel production. During the last few years several types of steel castings have been replaced by high grade iron, and further progress in this direction is confidently expected. In this connection a special word of warning is necessary. If cast iron is to increase its field of application at the expense of steel castings it must virtually retain iron moulding practice, alloy additions must be restricted to the cheaper varieties and the total additions less than 3 per cent., and any heat treatment must be of a simple and rapid character. With a knowledge of the developments now taking place in iron and steel metallurgy, coupled with an appreciation of the fact that we are passing through an age characterised by incessant demands for economy in material and methods, we admire, but place very little reliance on, our contemporary's burst in the field of prophecy.

New Works of August's Muffle Furnaces, Limited.

It was in 1912 that August's Muffle Furnaces, Limited, established themselves in the Thorn Tree Works, King's Cross, Halifax. For a considerable time these works have been taxed to their utmost capacity to deal with the increased demand for furnaces of various types. With the company's developments in other directions, *i.e.*, sand mixers, sand throwers, etc., the demand for additional space could no longer be ignored, and as the Thorn Tree Works offered no facilities for extension upon the necessary scale, a suitable site had to be found elsewhere.

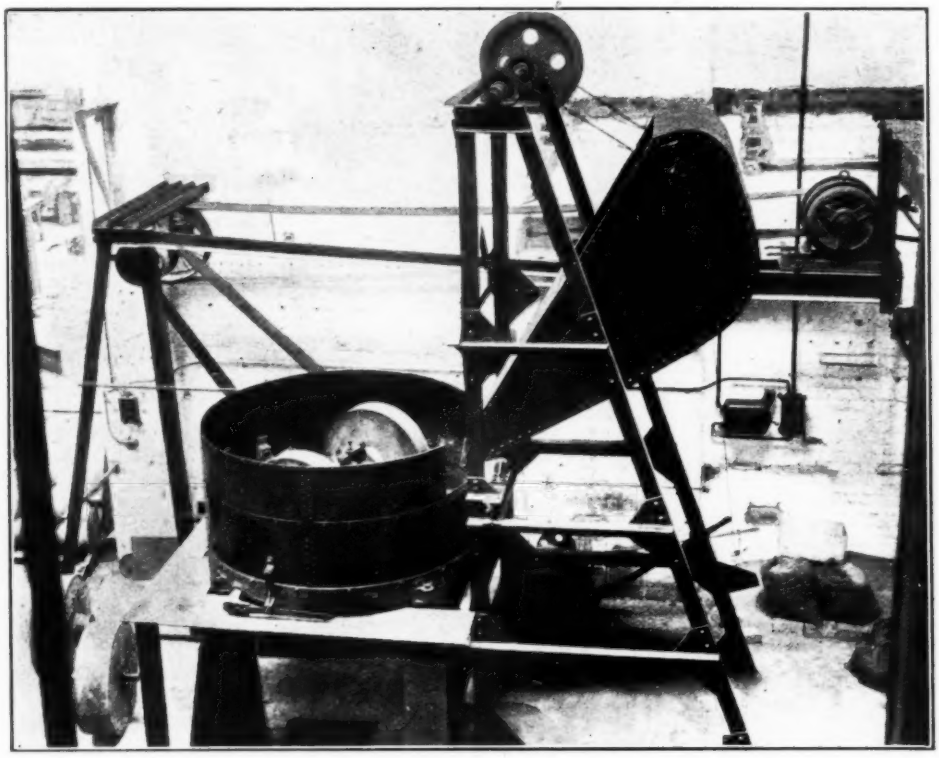

Fig. 1.—A No. 2 Sand Mixer and Bucket Loader in the Demonstration Plant of Messrs. August's Muffle Furnaces, Limited.

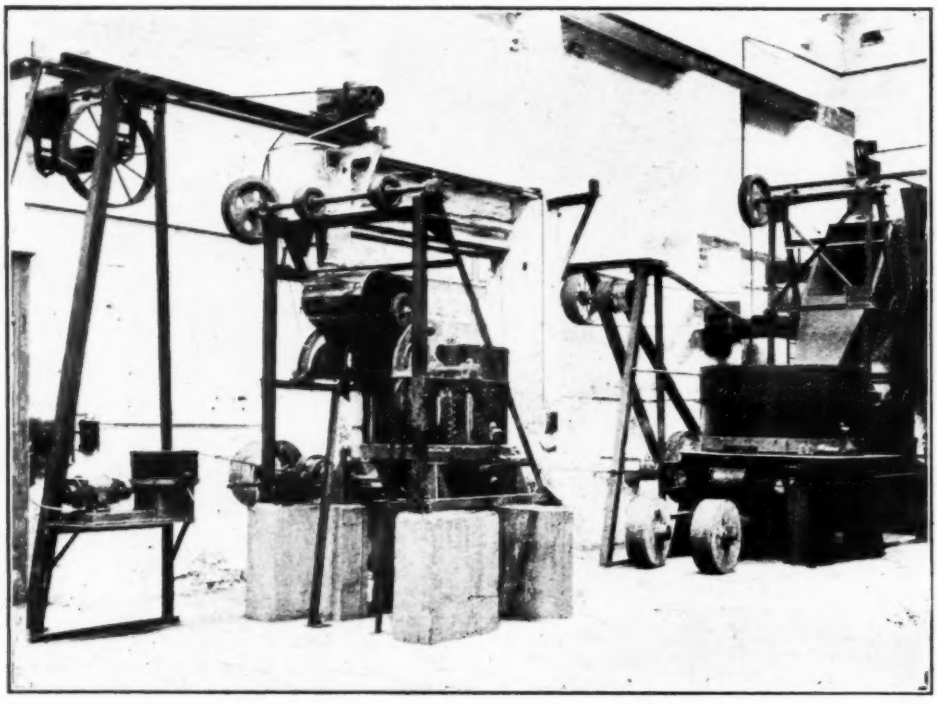

Fig. 2.—Sand Preparation Demonstration Plant. Messrs. August's Muffle Furnaces, Limited.

The company were fortunate enough to acquire some excellent shops in Exmoor Street, King's Cross, quite close to the old works. As the shops referred to had formerly been a branch works of

Messrs. John Stirk & Sons, they were particularly suitable, and their roominess not only provided for the necessary extensions to the works proper, but also made available space for the carrying out of a scheme which the company had long had in contemplation—the laying down of a demonstration plant for heat-treatment purposes where customers could see their own material dealt with under ordinary workshop conditions, an arrangement which is in every way desirable. A slight variation in the design of the furnace or modification in the method of working may easily make all the difference in the finished product, and it is preferable that such modifications should be made at the works of the furnace builder, rather than at the customer's works after the furnace has been installed.

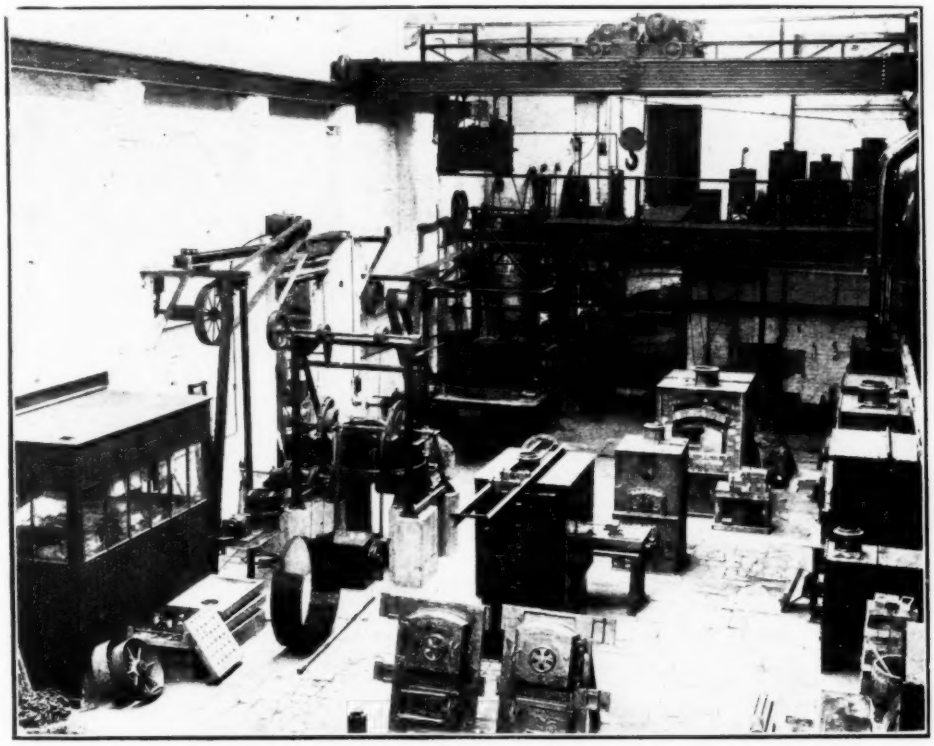

Fig. 3.—Heat-Treatment Plant and Erection Shop. Messrs. August's Muffle Furnaces, Limited.

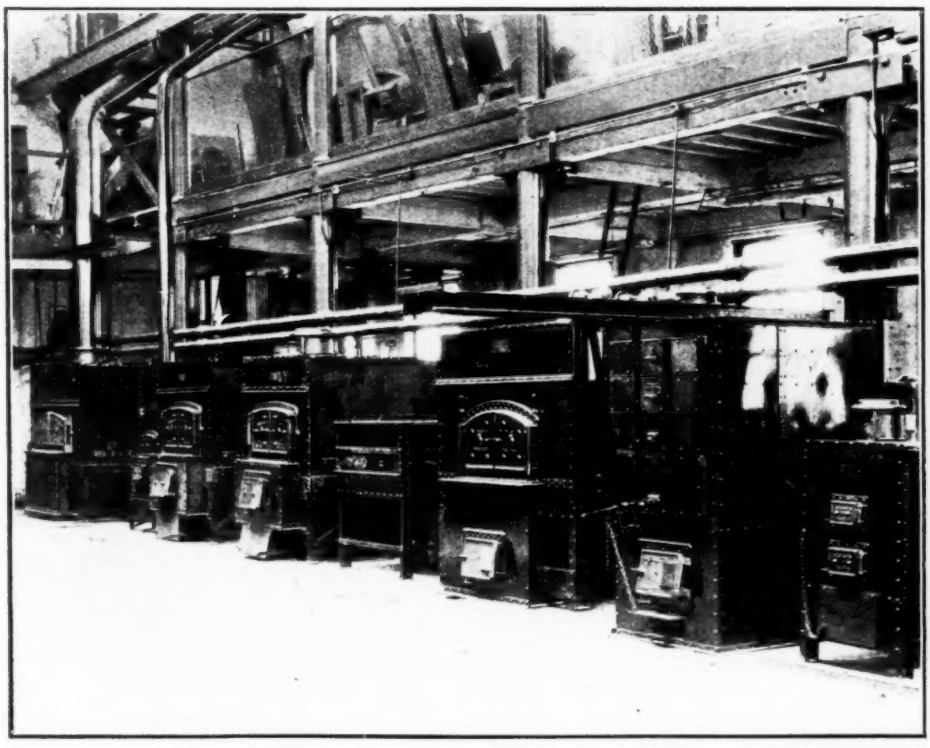

Fig. 4.—Heat-Treatment Plant Demonstration Shop. Messrs. August's Muffle Furnaces, Limited.

The works, which are fronted by suitable office buildings, are covered by three bays with ample roof lighting, whilst a central system of heating

is adopted, with separate boilers for the offices and works.

One bay is laid off for machine work, and this is served by a 5-ton Herbert Morris crane. A well at the street end of the bay enables carts to be brought in and discharged or loaded by the shop crane. This end of the bay is laid off for the steel stores, the material being carried on girder racks. The machine bay equipment comprises lathes, milling, drilling, planing, sawing, and plate-bending machines, the whole of the machines being independently motor driven, the most economical method in a shop where many of the machines are only run intermittently.

In this shop the whole of the structural work in connection with the furnaces, sand mixers, etc., is completed. A portion of the adjoining bay, which is served by a 5-ton Herbert Morris crane, is laid off for erection. In this bay also is a well-equipped tinman's shop, in which all the necessary pipes, ducts, and shields are manufactured. The smith's shop is contained in an annexe at the end of the bay, and this is served by a Pilkington 1-ton hammer.

The main bay, served by a 10-ton Herbert Morris crane, has a 20-ton Avery weighbridge at its entrance from the street. This bay is in part laid off for erection and despatch, whilst the space below the gallery, which extends along one side and across the end, serves for the storage of special bricks, standard castings, etc.

The remaining space in this bay is being laid out as a demonstration shop. The heat-treatment plant will consist of three standard furnaces of the No. 18 size, with muffles 6 ft. by 3 ft. 2 in. by 18 in.. Of these, the first, which is coke fired, is already in operation. The remaining furnaces will be equipped for firing with town's gas and oil respectively. The oil and water for the quenching are contained in cylindrical vessels placed in a well immediately in front of the furnaces. The water will be circulated from a large tank, which is placed on the roof of the building. The oil cooler will also be installed in an elevated position. The working temperature of these furnaces will usually be in the neighbourhood of 900 deg. C., but for special purposes they can be economically worked at any temperature between 350 deg. and 1,100 deg. C.

On the sand-treatment side of the shop there are already installed a No. 2 standard sand mixer which is driven by a 12½-h.p. motor, and a No. 1 mixer which is driven by a 10-h.p. motor. There is also a laboratory-size mixer under working conditions; this mixer is built along the same lines as the standard Simpson Intensive mixer, but is designed expressly for the use of research and experimental work on foundry moulding sand, and as it enables the value of different mixtures to be ascertained and the extent of the reclamation and reconditioning possible and desirable with used foundry sand, it becomes a very important factor in reducing foundry sand preparing costs, and a vital agent in the proper selection of new sands and bonds. Obviously it is equally suitable for research work wherever plastic materials are used and intensive mixing is necessary. The sand thrower, which has recently been perfected, will be a further feature of the sand-treatment demonstration plant.

It may be noted that the foreman's office is placed in a mid position, and as it has all glass sides he has an uninterrupted view of the whole of the works.

The gallery already referred to is laid off in part for a drawing office, with a print room adjoining. Beyond this is the pattern stores; whilst the end of the gallery is laid off as a miscellaneous stores.

A works' mess room is being equipped, facilities for cooking and heating food are also provided.

WE REGRET to learn that Mr. Ernest Wells, a director of and foundry manager to Messrs. Edgar Allen & Company, Limited, Imperial Steel Works, Sheffield, has not been well for some considerable time. His medical advisers have insisted on a prolonged holiday, which Mr. Wells has whittled down to a month. He is expected to return to business in early September, and we trust a complete cure will by that time have been effected.

IRON AND STEEL MARKETS.

Pig-iron.

MIDDLESBROUGH. — While admitting fully that August is proverbially a quiet month for business in general, such a depression has been seldom recorded in the annals of the Cleveland iron trade as is now prevailing in market operations, apart altogether from the usual holiday slackness always anticipated at this period of the year, whether regarded from the view-point of home or export transactions, the outlook is far from reassuring, and no expansion is looked for until the end of the month. Stocks of pig-iron at furnaces continue on an increasing scale, while last month only 2,741 tons of pig-iron were shipped from the Tees to Scotland, and the total to all destinations was only 7,763 tons, which compares with 9,709 tons in June. Prices remain as previously agreed by makers, and informed opinion is that there is no likelihood of an early reduction on the following quotations:—No. 1 Cleveland foundry iron, 72s. 6d. per ton; No. 3 Cleveland G.M.B., 70s. per ton; No. 4 foundry iron, 69s.; No. 4 forge iron, 68s. 6d. per ton.

In the Tees-side hematite market conditions are equally depressed, and prices are irregular, an average figure for East Coast mixed numbers now ruling about 75s. 6d., but even this figure could be shaded, as could 76s. for No. 1 quality. On the North-West Coast Bessemer mixed numbers stand nominally at £4 5s. per ton, delivered at Glasgow, £4 10s. per ton delivered at Manchester, £4 11s. 6d. per ton delivered at Sheffield, and £4 13s. 9d. per ton delivered at Birmingham.

Metals.

Copper.—Following the recent advance in quotations for warrant copper, there has been a slight set-back, but at last week's close prices had again recovered, and the tendency was steady. The reaction was largely due to the strength of American markets, where a big business has been put through in electro copper at steadily advancing prices. Apparently the rise has been too rapid in the States, and the subsequent reaction has been reflected here.

Official closing prices of standard copper have been as follow:—

Cash: Thursday, £56 7s 6d. to £56 8s. 9d.; Friday, £56 1s. 3d. to £56 2s. 6d.; Monday, £55 10s. to £55 11s. 3d.; Tuesday, £55 10s. to £55 11s. 3d.; Wednesday, £55 15s. to £55 16s. 3d

Three Months: Thursday, £56 15s. to £56 16s. 3d.; Friday, £56 10s. to £56 11s. 3d.; Monday, £55 17s. 6d. to £56; Tuesday, £55 17s. 6d. to £56; Wednesday, £56 1s. 3d. to £56 2s. 6d.

Tin.—The market for standard tin appears to develop further strength as the month advances, and is again approaching the £300 level. The statistical position would certainly justify this advance, for while it was not expected that the visible supply at the end of July would amount to a great deal, in spite of the very bearish forecasts that were made in the earlier part of the month, it was certainly not expected that the figures would show an actual decrease.

Official closing prices of standard tin have been as under:—

Cash: Thursday, £297 to £297 5s.; Friday, £299 10s. to £299 15s.; Monday, £295 10s. to £295 15s.; Tuesday, £296 5s. to £296 10s.; Wednesday, £297 to £297 5s.

Three Months: Thursday, £289 to £289 5s.; Friday, £290 12s. 6d. to £290 15s.; Monday, £287 10s. to £287 15s.; Tuesday, £288 10s. to £288 15s.; Wednesday, £288 10s. to £288 15s.

Spelter.—Though buying of ordinary spelter has been on a restricted scale, values continue consistently steady considering the quietness of the galvanising industry. Producers, however, appear to be in a fairly comfortable position, the knowledge that consumers did not take advantage of the recent fall in prices to buy, giving rise to the feeling that when they do come into the market values must improve.

The following are the week's prices:—

Ordinary: Thursday, £29 5s.; Friday, £29 1s. 3d.; Monday, £28 5s ; Tuesday, £28 7s. 6d.; Wednesday, £28 10s.

Lead.—The market for soft foreign pig is at last showing more signs of animation, and values are distinctly stronger on repurchases by the short interest under the influence of a sharp turn for the better in the American market, where the demand is reported to have been rather active of late.

The week's prices are appended:—

Soft foreign (prompt): Thursday, £24 5s.; Friday, £23 17s. 6d.; Monday, £23; Tuesday, £23 2s. 6d.; Wednesday, £23 10s.

Steel Foundry Practice Enlarged Upon.*

Alternative Moulding Method Described.

DR. P. LONGMUIR (Sheffield), who referred to the Paper as being of a type which was of very special interest to a Sheffield audience, heartily congratulated the authors on their very clear presentment of the making of a fairly heavy and intricate casting. The metallurgical part of the Paper was so good that one could have wished there had been more of it. As it stood, the description of the Siemens acid and the electric furnace were very effective, and, like the authors, he wished they had carried further their account of the differences which existed in the electric steel process when worked with one slag or when worked with two slags. The question of annealing was very effectively treated, and the microphotographs illustrated the point very well. Whilst he had nothing but praise for the Paper, he felt that the method of moulding was perhaps somewhat open to criticism, or, at any rate, that

MR. THOS. W. BROWN.

Mr. Brown, who was joint-author with Mr. Melmoth of a Paper on The Manufacture of a Large Steel Casting, has been engaged in the practical side of the production of steel castings for 45 years. He served his apprenticeship and had experience at several of the largest foundries, including the Darlington Forge. He left there in 1899 to take up his present post of head foreman of the steel foundry at Messrs. Thos. Firth & Sons, Limited, Sheffield. In this capacity he became intimately associated with the manufacture of steel castings from a few pounds to fifty tons in weight. He has been a member of the Institute of British Foundrymen since 1909, and has contributed several papers to its proceedings, for one of which he received the Diploma.

moulding practice on castings of this type was very much in advance of that given in the Paper. At one time it had been his good fortune to be interested in the production of similar castings, which at that time were made in phosphor bronze, and of weights equal to or exceeding the 8 tons 10 cwts. finished weight mentioned by the authors. He knew the inherent difficulties of steel castings as compared with phosphor bronze. Of course, there was the very much higher temperature, but, on the other hand, from the foundry point of view, phosphor bronze was far more searching into the pores of the mould than was steel, so that actually the moulding difficulties in the case of phosphor bronze were greater than in the case of steel. The mould was made in the floor, and the practice then—25 years ago—working from a solid pattern was somewhat similar to that described in the Paper, with the exception that the sides and ends of the mould were made as draw-backs, and were lifted away and stoved. By that means they were able to eliminate, or largely minimise, the very objectionable open fires in the foundry, and also considerably to cheapen the job and lessen the risks through excessive burning. The practice was, before bedding in, to have a plate, if possible one plate with suitable snugs on the outside, well off the sides of the job, or, if not, two or more plates were used bedded on girders. Moulding was followed as usual, the draw-backs lifted away and carried to the stove, the job was re-assembled, and—this was where they were in advance of the method described in the Paper—they never used a weight. No matter how interesting calculations of hydrostatic pressure were, a job of this kind should not be trusted to weights. After closing the mould, from the snugs in the bottom plates, wringers were carried up to binding bars across the top parts, and the whole bolted down. If the middle of the top part stood any chance of strain, that was wedged by a method very common at

MR. F. A. MELMOTH.

Mr. Melmoth, who with Mr. Brown presented a Paper on The Manufacture of a Large Steel Casting, is a native of Sheffield. He received his technical education at the Applied Science Department of the Sheffield University, and was awarded an associateship in metallurgy in 1913, together with Mappin medal for honours. His metallurgical career commenced in the research laboratories of Messrs. Brown Bayley's Steel Works, Limited, Sheffield, and after some years as assistant to chief metallurgist was transfererd to the steelmaking staff. After a period of experience in open hearth and electric furnace steel production decided to specialise on the latter, more particularly from the point of view of its applicability to steel castings. He joined the firm of Messrs. Lake & Elliot, Limited, Braintree, in 1918, as steel department manager, and was simultaneously employed in a consulting capacity by Messrs. The National Steel Foundry, Limited, Leven, Fifeshire. He was later appointed foundry manager of Messrs. Lake & Elliot, Limited, which post was held until his appointment to present position of foundry manager to Messrs. Thos. Firth & Sons, Limited, Sheffield, in 1926. Has contributed several papers on electric steel and malleable castings to the Institute's proceedings.

that time in foundries on the Clyde. Loose plates were put on the inside of the holding-down bolts and the space between rammed up as in a pit. Not even phosphor bronze, with its penetrating action, could possibly find an outlet, and the job was done far more safely than by merely weighting down.

Welding Steel Castings.

With regard to the preparation of sand, he fully appreciated the authors' reticence in the matter, and respected it, but he welcomed their frank attitude in regard to welding. The man who could produce a perfect, flawless casting every time was unknown to him at any rate. Something in the nature of welding was sometimes, though not often, essential, and when it was essential why hide the fact? It was no detriment at all to the casting, and the tensile tests given in the Paper constituted valuable support in this

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* A discussion on "The Manufacture of a Large Steel Casting," a Paper read before the Sheffield Convention by F. A. Melmoth and T. Brown.

respect. Discussing inspection, he said they all had that to meet, and the kindest thing they could say about it was that it was just a very necessary evil.

Mr. E. Longden, referring to the fins in Fig. 3, said he supposed their purpose was to strengthen the casting and prevent cracking, but he asked if it were not the common practice nowadays to omit fins and use chills. The fin, of course, had a slight chilling effect locally. With regard to the method of moulding, it was to a large extent a matter of expediency; and also whether or not the floor was prepared for that method at the moment. It made a difference to the cost of moulding if one had to sink a pit and lay down girders, binders and plates, and so on. In an iron foundry one must make the casting where it was not always the best because the pits may be in use for other work. The determination of the hydrostatic pressure was not easy. That was why it was better to fasten down with binders if possible. Not only had one to consider static pressure, but pressure from the gases which were forming, and which acted curiously.

Size of Feeder Heads Criticised.

Mr. D. C. Lloyd said it appeared, from the photographs of the casting, that the heads were rather small, especially for steel, which he imagined was run fairly hot. He asked, therefore, whether the authors could get definite soundness underneath the heads, in view of the fact that they were rather small heads and that there were rather few of them for a casting of this size.

A Successful Welding Job.

Engineer-Commander Jackson, discussing welding, said that, if it were properly carried out by a competent man, he would have no hesitation whatever in accepting a casting which had been electrically welded. No doubt Mr. Brown would remember one very big job which was done at Messrs. Thos. Firth and Sons at the time he (Engineer-Commander Jackson) was serving in the Royal Navy. This particular casting was for H.M.S. *Hood*, and had a defect on a part of the steel casting subject to steam pressure, and although electric welding is not permitted on such surfaces, in this particular case permission to electrically weld this casting was given by the Admiralty. It was subjected to very severe and searching tests in the presence of the Deputy Engineer in Chief of the Navy, and as a result was accepted and put into service, and so far as he knew was still satisfactory.

Mr. W. H. Poole suggested that the feeding effect of some of the risers on the casting described might be improved, and asked if the authors really thought that the feeders used were of the right size and shape. He considered that the diameter of the necks in at least two of the three, was very small, and if it were much bigger one would get a better feeding effect with less height of metal.

Charging Electric Furnaces.

A member asked whether the scrap charged into the electric furnace was heavy or light scrap. The authors had said that they put the scrap in first and the turnings on top, in order to get better working, but he asked whether they did not find that the molten steeel dropping from the turnings tended to solidify on the bottom of the furnace, so that when the furnace was cast some of the steel was left behind on the bar.

Use of Brackets.

Mr. H. L. Turner, dealing with the use of brackets, said his experience had been that they were very useful in certain places, but in others they developed troubles of their own. He had found frequently that if one attached brackets running down the body of a casting, the contraction of the brackets—for they cooled very rapidly—set up tiny cracks at the ends of the brackets, and if the ends occurred in one straight line instead of being staggered there was produced a line of weakness right across the casting, which frequently, at the point of solidification referred to by the authors, developed into a hot pull right across the casting. He had also found that in certain instances where the bracket crossed the rib of metal one was trying to protect, it would set up a crack along the line of the bracket itself.

Mr. J. H. Cooper, referring to bracketing, said there were many different systems, but he had found that the chief difficulty arose when the brackets were made too large for the job. A bracket should be as thin as possible, so that when it was in a solid condition it was not sufficiently strong to tear the casting, and so as to allow the casting, although semi-plastic, to draw the bracket slightly—which could happen. Referring to welding, he asked whether the authors had found that in arc welding there was an increasing carbon content locally. Also, he asked what electrodes they would use with the quasi-arc or other systems. Whilst he considered that the Paper was very convincing, and demonstrated that the authors had a great deal of knowledge of the subject, he did agree with Dr. Longmuir that some of the methods adopted could have been slightly improved.

AUTHOR'S REPLY.

Mr. Melmoth asked that Mr. Brown might be excused from replying, inasmuch as he had been very ill for a month or so, but, with his usual pluck, had insisted upon attending the meeting for the presentation of the Paper.

Iron Oxide in Steel Thought to Increase Fluidity.

Replying to the various points raised, Mr. Melmoth, on behalf of Mr. Brown and himself, thanked Dr. Longmuir for his remarks. He himself was patricularly interested in obtaining more details of moulding processes. With regard to the difference between steels produced under single and double slags, for a good many years he had been producing steel from the electric furnaces almost entirely, and that steel had to be of a type which could be used to run castings very different from that described in the Paper. The weights of the castings varied from probably ½ lb. up to 15 cwts., and occasionally perhaps even more, and, naturally, the main thing, apart from soundness, was fluidity—the ability to run thin sections. He knew that he had been accused of labouring the question of fluidity, but in the present Paper there was no need to mention it, as with casting of the type dealt with one did not require a very fluid steel in order to run it satisfactorily, from the standpoint of getting it all here. In the case of the other castings he had just mentioned, however, the proposition was a very different one. They had had to take a couple of tons of steel and "hand-shank" it round the foundry and cast these very small castings. After experiment and observations they had come to the conclusion that a steel made in the electric furnace under a single slag which contained fair amounts of iron oxide was definitely, so far as they could say from a works' standpoint, a more fluid steel than one under the more strongly reducing slags which were normal in the electric furnace process. From that they had evolved their present methods, and they were used almost consistently, always assuming that the scrap supplied was sufficiently good to justify it. He had been afraid that had that point been brought into the Paper it would have sounded almost like a repetition of a Paper which he had submitted to the Lancashire Branch some time ago, but it was certainly a point of very great interest that there appeared to be such a difference in the running properties of the material as produced by different processes in the same furnace. The explanation of it was not easy; in fact, he did not think it was known actually. It was put down, of course, to possibilities of dissolved oxide, and so on, but one was hardly able to say whether that was the exact explanation.

Moulding Methods.

With regard to moulding methods generally, he said it was obvious to everyone that the method adopted in any particular case was that which was most suited to the shop in which the job was being made. At the same time, he did not underestimate the value of the detailed description that Dr. Longmuir had given as an alternative to the method the authors had adopted, and Dr. Longmuir's description would be very helpful to them.

Use of Chills—A Warning.

Discussing Mr. Longden's reference to the use of fins, and the use of chills as alternatives, Mr. Melmoth referred again to the smaller castings he had handled some time ago, and said that the use of chills had been carried a very long way in connection with the production of fairly small castings, but one had to be very careful. There was no doubt that it was possible to produce, by the use of a chill, a state of affairs very much worse than would have been produced if nothing had been put on at all. A sudden cooling of one particular part, if a chill were a little over-effective, was almost bound to produce pulls in mild steels, and it was a very common experience to produce chill cracks in cases where chills were not very carefully thought out and designed. In the case of a fin or bracket the thickness must be such as would counteract satisfactorily the contraction stresses of the material and hold the casting together through its critical period.

Dealing with Mr. Lloyd's suggestion that the heads on the casting appeared to be rather small, he said that where steel castings were concerned the proof of the pudding was in the eating, or, in other words, in the fettling shop, and he assured Mr. Lloyd that he had not seen a cavity underneath a feeding head in any of these castings. If the heads had not been large enough, it was quite obvious, there would have been cavities there. Admittedly the question of the shape of head was a vital one, and one might criticise theoretically the shape of the heads, but the fact remained that the yield of casting was very satisfactory on this particular job, taking weight for weight and having in view the heavy machining allowances on it, and yet it was perfectly sound underneath the heads.

Melting Practice.

Replying to a member, he said the scrap used was the normal scrap such as was found in the works of the type of Messrs. Thomas Firth & Sons—crop ends and so on, and turnings. He had not found that in a continuously worked furnace the turnings on the top melted first, trickled down through the scrap, and formed solid on the bottom, so that their removal gave trouble. The furnace used was a Heroult furnace, and if any furnace was going to suffer from that trouble he was inclined to think it would be the Heroult, because none of the much-vaunted claims as to bottom heating effects were made in respect of it.

Brackets Need Study.

The point raised by Mr. Turner, as to the use of brackets, was one which Mr. Brown and himself had found of very great interest. Questions of the shape of the brackets, their thickness, where they ended, bringing them parallel in their effective ends and producing other pulls, were undoubtedly extremely important, and he agreed that if a rib or succession of ribs were put on in such a fashion as to pass on the contraction stresses to another definite line, it was quite probable that at that definite line a crack would appear. He gathered that Mr. Turner, when he had mentioned a bracket running down a body, had in mind a valve-like casting, having a rib running down the body and a large core inside. The authors' view as to that was that the rib, if too thick, caused a hot place, which, being delayed in its cooling by the presence of the rib, left the steel weak at one point and localised the contraction stresses at that spot. Consequently, the casting was liable to break down its whole length alongside the rib. He had seen cases in which there was such a rib, and in which it had been necessary to provide also smaller ribs in order to prevent the original rib cracking.

He agreed with Mr. Cooper that the brackets must be of the minimum thickness which would enable them satisfactorily to do the work they were intended to do. With regard to welding, he said he was not prepared to say, from memory, what was the thickness of the rods, but they were the ordinary quasi-arc rods, flux covered. Any rod of a similar type, flux covered, seemed to give similar results. The authors were of opinion that a flux-covered rod was necessary for fine welding.

Random Shots.

The programme of the forthcoming Paris Convention has at last come to hand, and it has aroused much interest, especially among those who still have pleasant recollections of its predecessor. Works visits on that occasion seem to have been relegated to a somewhat late hour in the afternoon, and it is a point of some satisfaction to note that 3.30 is the time appointed this year. The earlier the better so far as English tastes and habits are concerned!

* * *

Obviously the social side of the meeting is not to suffer from neglect, since we are to have a reception and a banquet, both followed by dancing, besides an elaborate luncheon programme. In view of the international nature of the gathering this is particularly welcome—we all know and appreciate the value of these social contacts, and judging by the extensive arrangements that are being made specially for the foreign delegates, the gathering should be both interesting and representative.

* * *

An interesting ladies' programme is also announced. It consists mainly of afternoon sight-seeing tours with tea at a variety of attractive places. There is a motor tour of Paris for the first day, intensive sight-seeing on the second and fourth afternoons, and a visit to Malmaison on the third day. We are amused to note in one case that "Metro" tickets will be provided for a certain part of one rather lengthy "promenade" in case of rain or fatigue! Surely with such elaborate provision for all possible contingencies no lady need hesitate to join the party!

* * *

While the echoes of the Sheffield Convention are still audible, it is interesting to note one respect in which the I.B.F. annual meeting is almost unique. There are societies that meet throughout the winter for the presentation of papers, and to them the summer conference is a joy-ride, consisting almost wholly of visits and social functions. Of this the recent meeting of the Institution of Mechanical Engineers in Birmingham was an excellent example. And on the other hand, there are bodies, like the Iron and Steel Institute, which hold few regular meetings during the year and consequently make the annual gathering mainly a serious affair of paper-reading and discussion. The I.B.F. manages to do both. Papers are presented throughout the year, yet at the same time there are plenty over when mid-summer arrives, nor is there anything wrong with them either as to quality or variety. Certainly, it would appear that the I.B.F. is able to make the best of both worlds!

* * *

A contemporary quotes the old lady who, hearing that a strike of iron-moulders had been settled, asked if they were the people who put the iron-mould on shirts and collars when they go to the laundry. Possibly the same old lady is under the impression that a core-maker spends his time producing the cores that are just a shade too plentiful in dried apples, while the patternmaker is responsible for the paper patterns ladies use in their dressmaking!

* * *

A perverse fate seems to have ordained that August shall be the holiday month *par excellence*. You decide to be public-spirited and go away early; and by now you are wanting another holiday. You prefer—usually because you can't help it—to wait till September, and long before then you feel mentally and physically worn out. Your neighbours shut up their houses and go away and come back, sun-burned and quite offensively pleased with themselves, which does not help much. . . . No, the only thing to do is to move Heaven and Earth for an August holiday, and if Heaven and Earth alike stand firm then admit frankly that you are ill-used and unfortunate—no one will believe you if you say you *like* staying at home in August, anyway!

MARKSMAN.

XUM

On the Volume Change in Cast Iron during Solidification.*

A Criticism of the Double Diagram of the Iron-Carbon System.

By Kotaro Honda and Hikozo Endo,

In cast iron cooled at an ordinary rate of cooling we find generally both graphitic and combined carbons. As regards the formation of the graphitic carbon there are two theories—one that the graphite is a product directly precipitated from the melt and the other that it is a secondary product decomposed from solidified cementite. In the case of the first theory, the so-called double diagram—stable and metastable—is used, while in that of the second, the graphitisation being a secondary phenomenon, the ordinary single diagram is adopted. Five years ago Prof. T. Murakami and one of the present writers† published a paper dealing with the mechanism of graphitisation in pure cast iron and arrived at an important conclusion, viz., that the first theory is untenable. Some of the experimental facts which led them to the above conclusion are given below:—

(*a*) If a specimen of cast iron is quenched from 1,130 deg. C. when it has just solidified no graphite is observable, provided the alloy is hypo-eutectic; while in specimens quenched at 1,050 to 1,000 deg. C. a considerable amount of graphite is found in the microstructure. Moreover, in specimens very slowly cooled through the solidifying range the graphitisation is very small. If the graphite were a direct product from the melt it should be found in specimens which have just solidified and been quenched from 1,130 deg. C., or slowly cooled through the solidifying range; but this is not the case. (*b*) If the graphite were a product directly precipitated from the melt it must be found in a greater quantity round a graphite rod dipped in it; because a new phase easily appears when a nucleus of the same phase exists. But this conclusion is not confirmed by experiments. (*c*) Flaky graphite, which is similar to that produced during cooling from the melt, is also obtained by heating solidified alloys containing cementite from 1,000 to 1,100 deg. C. This fact clearly shows that cementite can graphitise and form flakes at a temperature below the eutectic point. (*d*) The graphitisation is not caused by temperature alone, but it is attributable to the catalytic action of carbon monoxide or dioxide.

The results of the present investigation of the change of volume during solidification also confirm the decomposition theory of graphitisation, as is explained below.

According to the above theory the change of volume in cast iron during solidification is the differential effect between the contraction due to solidification and the expansion due to the decomposition of cementite, and hence it may become positive or negative according as the amount of decomposed cementite is greater or less, as is actually observed. Next, in considering the matter quantitatively let us calculate at first the change of volume due to the decomposition of cementite. At room temperature the specific volumes of cementite‡ and graphite§ are respectively 0.1312 and 0.4545 c.c. The mean linear co-efficient of expansion between 20 and 1,130 deg. C. for graphite* is 0.0000024. The same co-efficient for cementite cannot be directly determined, as the carbide decomposes at high temperatures. But if we determine that quantity at high temperatures for steels containing different amounts of carbon and construct an expansion co-efficient-concentration curve the expansion co-efficient of cementite can be estimated by extrapolating the curve to the concentration of cementite. In this way we obtained 0.000015 as the mean linear co-efficient of expansion of cementite between 20 and 1,130 deg. C. By using these expansion co-efficients the specific volumes of cementite and graphite at room temperature were reduced to those at 1,130 deg. C., and found to be 0.1378† and 0.4581 c.c. respectively.

When cementite decomposes at 1,130 deg. C. into iron and graphite, a part of the latter element (1.5 to 1.7 per cent. C.) goes into the iron to form a saturated austenite and the silicon (0.08 to 2.08 per cent.) present in the eutectic austenite soon diffuses into the former austenite forming a homogeneous solid solution as regards the carbon and silicon. The specific volume of a 1.6 per cent. C. steel at room temperature is 0.1281 c.c. By taking the dilatation curve for the steel from 20 to 1,130 deg. its specific volume at 1,130 deg., or more correctly that of the austenite, can be estimated; in this way we found this volume to be 0.1376 c.c., the effect of the silicon on it being left out of consideration. Thus, knowing the specific volume of cementite, austenite and graphite at 1,130 deg., the increase of volume at 1,130 deg. caused by the decomposition of cementite can be calculated, the result being 11.8 per cent. of the volume of cementite.

If this quantity be multiplied by the respective percentages of the decomposed cementite in the cast iron in each case, the increase of volume, $\frac{\delta V}{V_{cm}}$, due to the decomposition, can be obtained. The same quantity with reference to the specific volume of liquid cast iron at 1,130 deg. can be obtained by multiplying the ratio of the specific volume of solid cementite by that of liquid cast iron at the same temperature. In this way the calculation of the expansion $\left(\frac{\delta V}{V_l}\right)_{dec.}$ due to the decomposition of cementite in the six specimens of cast iron was made and the results are given in the following table:—

Table I.

Specimens.	Gr.	Cementite decomp.	$\frac{\delta V}{V_{cm}}$	$\left(\frac{\delta V}{V_l}\right)_{dec.}$	$\left(\frac{\delta V}{V_l}\right)_{dec.}+\left(\frac{\delta V}{V_l}\right)_{sol.}$	$\frac{\delta V}{V}^{obs.}$
	Per cent.	Per cent.	Per cent.	Per cent.		Per cent.
1	3.08	46.2	5.47	5.26	1.66	1.65
2	3.06	45.9	5.43	5.24	1.64	1.66
3	2.80	42.0	4.97	4.78	1.18	1.18
4	2.20	33.0	3.90	3.76	0.16	0.47
5	2.06	30.0	3.55	3.42	—0.18	0.00
6	1.20	18.0	2.13	2.05	—1.55	—1.76

The contraction of volume in cast iron during solidification in the case where no cementite decomposes was found to be 3.6 per cent. Hence the total change of volume, when a partial decomposition of cementite takes place, is

$$\frac{\delta V}{V}=\left(\frac{\delta V}{V_l}\right)_{dec.}+\left(\frac{\delta V}{V_l}\right)_{sol.}$$

This total change is given in the sixth column in the above table. By comparing these values with those actually observed, given in the last column, it is concluded that the calculated and observed values coincide with each other very satisfactorily.

The above favourable coincidence between the observed and calculated values confirms the correctness of the view that graphite present in cast iron is the decomposition product of cementite precipitated from the melt at high temperature. Thus, if the graphite present in cast iron be a decomposition product of cementite the double diagram of the iron-carbon system is not the correct representation of the observed facts.

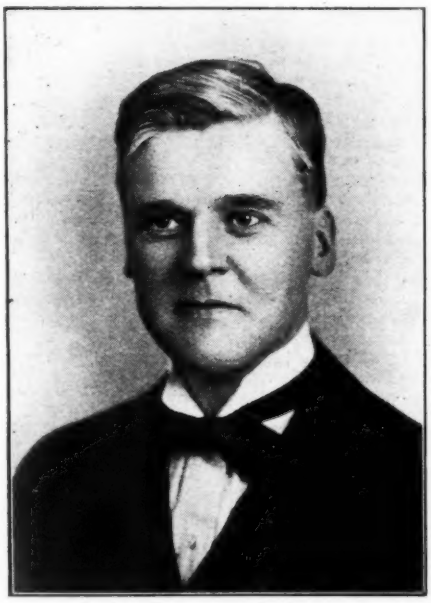
* Extracted from Science Reports of the Tokoku Imperial University, Vol. XVI., No. 1.
† Sci. Rep., 10, (1921), 273.
‡ Westgren & Phragmén; Iron & Steel Inst., 109, (1924), 167.
§ Cohen & Olie; Zeits. Phys. Chemie, 71, (1910), 385.

* Journ. Ind. & Eng. Chem., 4, (1912), 490.
† This volume is a little smaller than that given by F. Sauerwald and J. Weker; Zeitschrif. anorg. Chem. 1. c.

Developments in Malleable Cast Iron.*

Definite Field for Low Elongation Malleable.

MR. F. J. COOK (Past-President) was of opinion that there certainly were commercial uses for an iron which would give very high tensile strength, say, of over 30 tons per sq. in., with a moderate elongation of 3 per cent., in such things as transmission gear, heavy conveyor work, cam levers for Diesel engines, and so on, where one wanted good strength and rigidity. A few years ago enormous elongations were obtained in America with malleable iron, and very great stress was laid on that point, but anyone who was familiar with the work carried out over there now knew that they had dropped a great deal of that. They had found that it was not a distinct advantage in many cases to have an iron with the same attributes as lead, but that they required a malleable iron of a stiffer nature, and he could quite conceive that the advantages, for such purposes as he had indicated, of a high tensile strength would be greater than the advantages of an abnormally high elongation. Therefore, one could quite truthfully answer Mr. Taylor's question in the affirmative. Referring to a diagram exhibited by Mr. Taylor, which showed that, with manganese, the ultimate stress rose, then it dropped down, and later there was again a distinct rise. The tails of the diagrams for ultimate stress, yield and elongation took the same direction, and it appeared that Mr. Taylor had left off at a point from which he ought to have continued very much further, because it appeared, if he had, he would have got within the range of the results which had been shown by Prof. Piwowarsky. If that were so, there were two ways of getting at a material which would give similar results, and he suggested, therefore, that Mr. Taylor should carry the work a little further in order to see whether the rise in the curve persisted. The subject was full of possibilities; the Paper was well conceived, and the work had been very well carried out.



MR. E. R. TAYLOR.

Mr. Taylor is on the research staff of the British Cast Iron Research Association, and his Paper dealing with Malleable Iron is a communication based on the work he has done whilst experimenting on that alloy. This work has been generally appreciated by the Industry. He is an Associate of the Royal School of Mines and a Fellow of the Institute of Chemistry.

MR. T. H. TURNER asked what the figure was at the end, where the direction of the curve changed.

MR. COOK replied that the ultimate stress was round about 26 or 27 tons. The manganese content at the point of change was round about 1 per cent.; above that, there was a distinct advance to such an extent that it looked as though it might go up considerably further.

Higher Sulphur in Skin.

MR. W. H. POOLE asked Mr. Taylor if he thought that a malleable iron of 30 tons tensile and 3 per cent. elongation was of very high grade, because he himself regularly tested malleable of 30 and 40 tons tensile, and from 7 to 12 per cent. elongation. He also asked why it was that there was more sulphur in the skin than in the remainder of the iron, and what, in Mr. Taylor's view, actually took place to cause that high sulphur content. He also asked that when Mr. Taylor carried out any further experiments he would keep in mind the practical casting results in the foundry, because when trying out casting results one often experienced a lot of trouble. If one cast a high-manganese metal and a low-manganese metal in the foundry one found an appreciable difference.

MR. E. LONGDEN asked Mr. Taylor if, in view of the importance of sulphur in the metal used for malleable iron castings, he had carried out any research into de-sulphurisation. In grey iron it was not so important as in malleable iron, but during the last eighteen months metallurgists had been somewhat confounded, because he had regularly produced metal with a sulphur content of 0.16 per cent., the sulphur having no damaging effect on the metal.

Migration of Sulphur in Malleable.

MR. F. H. HURREN said that the Paper was very interesting and useful, inasmuch as serious research work on whiteheart malleable had been sadly neglected. Mr. Taylor had proved conclusively in his Paper and in the test results given in the Carnegie Scholarship Memoirs that high manganese was not a desirable factor, inasmuch as, although the tensile was increased, the bend test result was seriously reduced. He did not quite agree with the statement in paragraph 4 of Mr. Taylor's conclusions, to the effect that there seemed to be no reason why medium and high-sulphur irons should not be employed. Despite what Mr. Fletcher had said about the difficulty, with a blast furnace, of producing cast irons to specification, he did not see why the very high sulphur irons now put on the market could not be improved upon, and, with all due deference to the pig-iron manufacturers, he considered it was up to them to produce irons lower in sulphur and remove the trouble from the man who had to make the castings. Another interesting point brought out by Mr. Taylor was the fact that during annealing some castings lost sulphur and others gained. He himself had found that out in a number of tests, but had never realised what the explanation was until Mr. Taylor had proved it in his Paper, and he thanked Mr. Taylor for having given it.

AUTHOR'S REPLY.

MR. TAYLOR, replying to the discussion, said that Mr. Cook's suggestion that the manganese content be carried further was a good one, because at about 1.25 or 1.3 per cent. manganese things did not seem to be going better. Those who wanted a high tensile malleable cast iron would get it with 1.25 per cent. manganese, but the elongation was only moderate, *i.e.*, 3 per cent. There must be many purposes in engineering for which such a material of high tensile strength and low ductility would be specially valuable, but such a malleable cast iron did not appear to achieve the popularity that perhaps it might. He would take the opportunity, when he could, of increasing the manganese in order to see what happened, because at 1.3 per cent., where he had finished, the tensile strength was soaring up to 35 tons per sq. in., and would perhaps have reached 40 tons. It might be that the properties of the material would coincide very closely with those obtained by Prof. Piwowarsky. Prof. Piwowarsky

* A discussion on "The Effect of Manganese and Manganese Sulphide in Whiteheart Malleable," by Mr. E. R. Taylor, presented to the Sheffield Conference.

had indicated, in reply to the discussion on his Paper, that if he had lengthened the annealing period beyond a quarter of an hour he could have increased the elongation of 10 per cent., Presumably, however, in reaching an elongation of 10 per cent., the strength of the material would have been reduced somewhat. The action of the sulphur during annealing very likely explained some of the failures that had occurred in the past. He could not imagine that the properties of a malleable cast iron containing a large percentage of sulphur and no manganese, even if the sulphur were eliminated during annealing, would be so good as they would be if one started with a more select pig-iron and had no elimination of sulphur. It seemed probable that the elimination of a large percentage of sulphur would be detrimental during annealing. If one started with a pig-iron containing 0.5 per cent. sulphur, and perhaps eliminated half of that sulphur so that it was reduced to 0.25 per cent., the effect of having eliminated it would be to leave traces of injury. There were cases on record which showed that that was the case.

Papers for the Paris Conference.

The following gentlemen have promised to submit Papers to the forthcoming Paris Convention, to be held from September 7 to 10. They have been divided into groups, presumably for the purpose of holding joint discussions:—

Iron.—Messrs. Gautard (Manager Société Nord, Paris); J. T. Goodwin, M.B.E. (President of the Institute of British Foundrymen), "The Use of Directly-Produced Granular Iron from the Foundry Point of View"; Jesse L. Jones (Westinghouse Company, Pittsburg, Pa.); A. Levi; and R. P. Lemoine (Paris Technical High School), "The Application of the Electric Furnace to the Iron Foundry, with Special Reference to the Duplex System."

Testing Cast Iron.—Professor Pishek (Brno, Czecho-Slovakia), "Testing Methods for Cast Iron"; Professor Guardet (Belgium), "Simple and Rapid Methods of Controlling the Properties of Cast Iron"; Messrs. P. Herman and H. Neuquin, "Some Methods of Testing."

Organisation and Costing.—Messrs. Tocheport, "Costing," and M. Le Thomas.

Sands and Non-Ferrous Metals.—Messrs. R. P. Lemoine (Paris Foundry High School), "Electric Melting of Copper Alloys"; Leon Thomas (Manager, Citroën Foundries and President French Foundry Technical Association), "Some Properties of Special Brasses"; Guilio Sirowich (Professor, Rome Engineering College), "Sand Testing"; Professor Portevin, "Macrostructure of Non-Ferrous Metals and Alloys," and Dr. J. Galisbourg, "The Use of Nickel in American Non-Ferrous Foundries."

Machinery for South Africa.

It is interesting to note that the South African mining industry purchased in 1926 plant equipment and machinery to a total value of £2,476,349, as compared with £2,314,209 in 1925. Of the total £2,179,137's worth was imported—a gain of £188,290, and £297,212 worth was of local production—a decrease of £126,150. The following table gives particulars of some of the purchases:—

	Imported.	Local production.
	£	£
Coal-cutting machines ..	14,708	—
Spares	23,132	2,025
Machinery and tools	589,283	43,007
Spares (not electrical) ..	370,664	91,246
Rock drills	107,598	750
Spares	317,977	150,921
Electrical machinery	619,028	3,447
Spares and fittings	136,747	5,816
Total	2,179,137	297,212

British participation was well sustained, and there was little or no change in the competitive position of any of the principal suppliers—the United Kingdom, the United States and Germany.

Pitfalls in Brass Scrap.

By T. B. Henderson.

To parody the proverb one might say, "It is a wise scrap dealer who knows his customer," and "knowing" in the sense that he will forbear from sending in deliveries of material to which that otherwise estimable man takes violent exception. It is always a mistake to upset "the other man" in business.

While for many years certain buyers in this country have definitely objected to small-arms cartridge cases, whether "muffled" or "clean," there has always been a market for this class of scrap, of which the mixture is pure and regular. Latterly, however, objections have been raised in quarters hitherto vulnerable, and the complaint is always the same—the product, be it brass strip, wire, or sheets, develops cracks, and the cause of the trouble is fulminate of mercury in the cap. Short of beheading the offenders, it looks as if the 0.303's days are numbered except for cast work.

How many dealers have been deceived at some time or another by a parcel of tubes "for re-drawing?" The superficial inspection may not reveal interior defects, and even the cautious fellow who insists upon splitting lengthwise a few of the units picked at random from the bulk may find later that he has bought a "fifty-fifty" lot, having been unlucky enough to draw his samples out of the "good" half. As the premium for re-drawing tubes is in the neighbourhood of £5 per ton, the hoped-for profit looks pretty sick when a forced sale as scrap for melting proves to be the only way out.

Brass rod scrap requires very careful inspection, for iron is very often present in a free state and in a form frequently difficult to detect. The safest plan is to have two or three bagfuls from the *middle* of the dump tipped out, and the contents subjected to the magnet's detective scrutiny, for most up-to-date works to-day are equipped with magnetting machines, and manufacturers do not take risks.

The parcel of brass scrap that is offered on the understanding that it *may* contain a small—oh, quite a negligible!—quantity of something that ought not to be there, is better left alone, for nobody has yet succeeded in defining just what a "small" proportion is. The "snag" may be "tramp" iron or soldered joints, or tin may be present either as a coating or in the mixture of the metal. Fuse noses are often marred by a nickel wash, and in a parcel of rolled brass scrap there may be a "small" proportion of cast material.

English tube scrap is not any too plentiful nowadays and fair quantities of American pipes are crossing the Atlantic for sale on our market. While our home-made product is usually 66 per cent. copper at least and more often 70, much of the material manufactured in the States shows only about 63 per cent., and must be valued accordingly. It is worth remembering too that America is 3,000 miles away, and this makes it difficult to press a complaint home.

Annual Meeting of Ohio Foundrymen.

The annual meeting of the Ohio State Foundrymen's Association will be held at Cedar Point, Ohio, August 19 and 20. The speakers include Mr. S. W. Utley, of Detroit, the president, American Foundrymen's Association, who will deal with "The Foundry Industry"; Mr. Eugene W. Smith, general foundry superintendent, Crane Co., Chicago, whose subject will be "Sand Control from a Foundryman's Viewpoint"; Mr. Phil Frankel, who will speak on "New Merchandising Methods for the Foundry Industry," and Mr. Willis Wissler, Ohio, whose topic will be "Labour Management."

In addition to the addresses there will be luncheon table discussions on foundry costs and other foundry problems. An informal banquet will be held on the evening of August 19.

The Improvement of Aluminium Bronze as an Engineering Material.*

By Dr. R. C. Reader (Birmingham).

The aluminium-copper alloy containing usually 10 per cent. aluminium, and commonly known as aluminium bronze, is an alloy whose useful properties are only just beginning to be fully realised and appreciated, and when they are better known they will ensure for the alloy a much wider field than it has at the present time. There are, however, one or two difficulties that are encountered with the use of this alloy, and because of this the writer considered that a Paper dealing with the various methods of avoiding these difficulties, as well as with the methods of still further improving the alloy, might be of assistance, and he has therefore prepared this Paper and hopes that it will be of assistance as well as of some value to those foundrymen who make and use aluminium bronze.

During the last twenty years many Papers have been written on this alloy dealing with the large amount of experimental work which has been carried out on it. In this connection mention may be made of the work of Carpenter and Edwards, and Rosenhain and Lantsberry who worked on the mechanical properties, and of Curry and Stockdale who worked on the equilibrium diagram. Since the very comprehensive work of Carpenter and Edwards in 1907 Papers have appeared at frequent intervals dealing with various properties of aluminium bronze, and in this group may be mentioned the works of Corse, Comstock, Rickard, Whittaker and others.

The chief inference to be drawn from the above published works on aluminium bronze is that it possesses many properties superior to those of other non-ferrous alloys, and it is now known that these useful properties of the plain 10 per cent. aluminium bronze can be further improved and troubles avoided by the following methods:—(1) The addition of one or more extra elements; (2) the use of chill castings instead of sand castings; (3) correct casting temperature, and in the case of die casting, a correct mould temperature; (4) correct mould design and correct position of the casting in the mould; (5) correct position of the feeder head; and (6) the employment of heat treatment.

The mechanical and physical properties of aluminium bronze can be varied more or less considerably by any one of the factors enumerated above, and so it is intended to deal with each of these points in turn. In so doing, however, the writer wishes to make it clear that he is drawing freely on the work of others. He is, however, able to confirm the results of all these from his own work and observations.

The Influence of Added Elements.

The normal 10 per cent. aluminium bronze in the chill cast state possesses the following mechanical properties: Tensile strength up to 36 tons per sq. in.; a yield point of 12 to 13 tons per sq. in., with an elongation of 30 to 35 per cent. on 2 in. These properties alone are sufficient to indicate the usefulness of the alloy for constructional parts, even more so when it is remembered that these properties are accompanied with a high resistance to fatigue. This latter property should be kept in mind when comparing this alloy with other non-ferrous high tensile alloys, which may approach it in tensile strength but always fall short in fatigue tests.

Although 10 per cent. aluminium bronze is a suitable alloy for many purposes, its mechanical and physical properties can be improved by the addition of one or more elements, such as iron, nickel or manganese. Advantageous results in some respects may be obtained by the addition of 1 to 2 per cent. of lead, such as anti-frictional properties, though the effect on the strength of the alloy is not pronounced. Additions of tin and of silicon should be avoided, as they reduce the ductility of the alloy very considerably.

* Paper presented to the Chicago Meeting of the American Foundrymen's Association.

Effects of Addition of Iron.

Iron added to aluminium bronze improves the properties in two ways. Firstly, it increases the resistance of the alloy to attack by some of the acids,* and it also raises the mechanical properties of the alloy. It has been found by various investigators that maximum mechanical properties are obtained by the addition of about 3 per cent. iron, when the alloy possesses a tensile strength of about 40 tons per sq. in., a yield point of about 14 tons per sq. in., and an elongation of 20 per cent. Further additions of iron should be avoided as they bring about reduced ductility combined with a possibility of unsoundness.

Aluminium bronzes containing up to 3 per cent. iron are suitable alloys for die-casting purposes, when slightly higher mechanical properties than those given above can be obtained, due to the greater chilling effect in this method of casting. The alloy is one also eminently suitable for hot working, and in this field it has unlimited possibilities, since it is extremely ductile at high temperatures.

Beneficial results also follow the addition of iron because the presence of iron imparts a fine crystal structure to the alloy, by providing a large number of nuclei from which crystallisation starts. This fact is of extreme importance, since it greatly minimises the effects of "self-annealing." This point is mentioned later. A useful aluminium bronze alloy containing iron is: Iron, 2 to 3 per cent.; aluminium, 10 per cent., and the remainder copper.

Effects of Addition of Nickel.

Additions of nickel to aluminium bronze affect the properties in various ways, some advantageous and others disadvantageous. For example, the addition of 7 per cent. nickel to 10 per cent. aluminium bronze raises the tensile strength to its maximum of about 42 tons per sq. in., but this rise is accompanied by a big decrease in ductility, and this restricts the use of this alloy for some purposes.

One of the chief advantages brought about by the addition of nickel to 10 per cent. aluminium bronze is that it increases the density of the alloy, and it is thereby all the more able to withstand hydraulic pressure. This is accordingly a field where these alloys could be utilised to advantage.

A further advantage obtained by the use of nickel in aluminium bronze is that the resistance of the alloy to corrosion by sea water is increased. The best alloy recommended for aluminium bronzes containing nickel, is nickel 5 to 7 per cent., aluminium 10 per cent., remainder copper.

Effects of the Addition of Manganese.

Additions of small amounts of manganese to aluminium bronze improve the mechanical properties, in that the yield point and tensile strength are raised without any marked reduction in ductility. This is illustrated by the following figures taken from the eighth and ninth reports to the Institute of Mechanical Engineers:—

Cu.	Al.	Mn.	M.S. tons per sq. in.	Y.P. tons per sq. in.	E %
90.1	9.9	—	36.9	12.4	31
89.1	10.0	0.9	39.9	16.0	25

It will be seen from the above that the addition of 1 per cent. of manganese raises the yield point by nearly 4 tons per sq. in., which makes these alloys the equal of the better known aluminium bronzes containing iron. The addition of manganese to aluminium bronze in no way affects its resistance to corrosion, while, on the other hand, it is a useful addition to make when the alloy is to be subjected to abrasion.

The Use of Chill Castings.

The chief improvement in aluminium bronze to be obtained from the use of chill or die castings

* Corse, W. M., "Aluminium Bronze—An Acid Resisting Material." Trans. A.S.S.T., 1926.

instead of sand castings is best illustrated by the following description of what happens in a sand casting.

It has been shown by A. B. Wilson* and others that 10 per cent. aluminium bronze is subject to "self-annealing" when allowed to cool slowly, as when cast in sand. This property of self-annealing is brought about by the decomposition of the beta phase of the alloy on slow cooling into the two stable phases alpha and delta. The alpha phase is soft and ductile, while the delta phase is extremely hard and brittle. Moreover, on the decomposition of the beta phase into alpha and delta these latter phases exist in the lamellar form, resembling pearlite in steel, and the slower the cooling the coarser is this structure, with the result that the planes of hard delta provide planes of excessive weakness, along which fracture will readily take place when a casting containing it is subject to vibratory stresses.

There are three ways of preventing "self-annealing," and they are: (*a*) By removing the casting from the mould as soon as it has solidified and allowing it to cool in the air; (*b*) by the addition of 2 or 3 per cent. iron; and (*c*) by the use of chill casting.

It has been suggested that "self-annealing" can be avoided by lowering the aluminium content to 8 per cent. While this may be true, it is not to be recommended, since the reduction of aluminium content is accompanied by a corresponding reduction in mechanical properties, but the methods given above result in improved properties in addition to the avoidance of "self-annealing."

The exclusive use of chill castings is the best method of the three, since there are some further advantages, such as increased mechanical strength, a better surface appearance, and often increased soundness. Also casting the alloy in chill moulds lessens the effects of dross which are encountered in sand casting. Casting in chill prevents "self-annealing," because the casting is cooled too rapidly to allow of the decomposition of the beta phase into the alpha plus delta, thereby keeping the brittle delta in solution.

The following figures taken from the work of Carpenter and Edwards illustrate the improved properties that are obtained by the use of chill casting:—

	Sand Cast.	Chill Cast.
Yield point tons per sq. in. ...	11.3	12.4
Tensile strength tons per sq. in.	31.70	36.93
Elongation per cent. on 2 in.	21.7	30.5

Casting and Mould Temperatures.

It is well known that the question of casting temperature is of the utmost importance when casting some of the non-ferrous alloys, as, for example, phosphor bronze, the properties of which can be seriously diminished by the use of an incorrect casting temperature. This, however, is not found to be the case, within reasonable limits, for aluminium bronze, there being a fairly wide range of casting and mould temperatures that can be used without varying markedly the properties.

The most suitable casting and mould temperatures to be used should be found by trial and error for each particular alloy and mould. It will be found that, although slight, superior properties will be obtained by the use of the lowest casting temperatures at which it is possible to obtain a completely formed casting. Also, it will be found that sounder ingots are obtained by the use of lower mould temperatures since the chilling effect is greater.

Mould Designs and the Position of the Casting in the Mould.

The question of mould design is one of extreme importance when the aluminium bronze alloys are die cast, and the importance is such that the success or otherwise of the process depends on the design of the mould for the particular job, and since this is a very specialised branch, the writer is unable to offer much advice on that topic. He would, however, like to draw attention to the improvements, particularly as regards surface appearance, and this is all important in die casting, that can be obtained from so designing the mould that the casting is prepared in a horizontal position. This results in an improved surface since splashing is avoided when pouring, as the metal enters the mould in a somewhat similar way to bottom pouring and causes no splashing through impinging on cores or against the sides. Also, it will be found that a better surface condition is obtained by the use of the larger feeder heads, which also assist in producing sounder castings.

* "The Foundry," Oct. 1, 1920, p. 776.

Position of Feeder Heads.

In commercial practice it is the custom to place the feeder head on a casting at a place where the casting is of narrow cross-sectional area. This is done to facilitate the removal of the feeder head, but yet while this may be good practice from an economical standpoint, it is bad practice in other ways. For example, the thin sections of a casting will be the first to solidify, and the remaining still liquid thicker sections will, on solidification, contract and cause the formation of internal cavities, since they are cut off from the supply of still molten metal in the feeder head by this solidification of the thin section of the casting immediately under the feeder.

The above description shows that in the design of moulds it should be so arranged that the feeder head is attached at a thick portion of the casting and that the thin portions of the casting are the first to be formed. When this is done it will be found that the thin section is fed by the supply of molten metal in the thicker portion above, and this in turn fed direct from the supply in the feeder head, thereby resulting in the production of much sounder castings.

Heat Treatment.

One of the chief points in favour of aluminium bronze compared with other copper-rich non-ferrous alloys is that it is very susceptible to the influence of heat treatment and the mechanical properties of the alloy can be very widely varied by it. For instance, the properties can be so varied as to give high tensile strength with a low ductility, a high ductility with low tensile strength, or many happy mediums.

Experimenal work on the heat-treatment of aluminium bronze has been carried out by Corse and Comstock* and by Grard† and others. These workers show that by means of quenching from a high temperature, followed by an annealing, the maximum useful properties can be imparted to the alloy. The treatment recommended is quenching from 900 deg. C., followed by an anneal at 675 to 700 deg. C. It has been found by the writer that this is the treatment that should be given to those castings which have "self-annealed," when the normal properties for the alloy will be restored to it.

From the above it is evident that the development work on aluminium bronze is progressing along correct technical lines, all of which means that the engineers will have available for their purposes and needs better known and more reliable alloys in the aluminium bronzes than ever before. Its well-known uses as an anti-corrosive material, as a strong structural bronze and as a material for parts to resist wear, such as worm gear wheels and certain types of bearings, are already well known, and it is hoped that the information in this Paper will help to round out the picture of the possibilities of this important material.

THE SUMMER MEETING of the Whitworth Society was held in Derby on the same day that the members of the Institution of Mechanical Engineers were visiting various works in Derby. Members of the Society who were not members of the Institution of Mechanical Engineers were entertained at lunch by the L.M. & S. Railway Company. Thirty-three Whitworth men then went by charabanc to Darley Dale Church, where a wreath was deposited on the tomb of Sir Joseph Whitworth Bart., by the President, Dr. F. P. Purvis. The party then proceeded to Bakewell, where they had tea, and the dinner was held at the Midland Hotel, Derby, when thirty-four members were present. The new president, Mr. Thos. Sugden, was installed in the chair, and a number of interesting speeches were made. There are now 503 members on the roll.

* "The Foundry," Jan., 1917, pp. 21-29.
† Grard, "Aluminium and its Alloys." Constable, London, 1921.

The Importance of Cheap Town's Gas for Foundry Practice.

By R. Storey, O.B.E., M.Sc.*

Foundries use gas for very many purposes—in particular in core stoves, melting furnaces, mould and ladle dryers. In each of these cases the usual alternative fuel in this country is coke. The sole reason for the much more frequent use of coke in the foundry rather than gas is that the direct cost of solid fuel is at present less than that of gas. If it were not so, probably no coke would be sold to foundries for use except in the cupola. The convenience, cleanliness and ease of regulation of gas-heated appliances renders them far superior to coke-fired appliances doing the same work; and where gas is now used it is considered that the benefits it gives outweigh the disadvantage of its higher cost.

The foundry industry relies, too, on the consumers of gas for a large portion of its sales. Gas cookers, gas fires, gas mains and numerous other gas appliances all contain castings in very large proportions, and the production of these has given profitable work to many foundries during the recent disastrous years of trade depression. More gas used must mean, therefore, more work for the foundry industry; and surely the chief reason that gas appliances, and gas fires in particular, are not much more widely used is that the cost of the gas consumed is so high. The writer's experience is probably only that of thousands of other users of gas. His gas bill for last December quarter was staggering—partly of course as the result of the higher price of gas caused by the coal strike. Something had to be done about it, and he instituted a daily reading of the gas meter. At once it became obvious that while gas was so expensive, gas fires cost far too much to run for the service they gave, and as far as possible they had to be replaced by coal fires—a thoroughly retrograde step from every point of view. We do not get enough sunlight to be able to afford the loss of it through the permanent partial eclipse caused by the smoke from innumerable domestic coal fires.

When, therefore, an advertisement is published in a Midland newspaper stating that gas, which is normally sold at a price not less than 9d. per therm, can be produced by modern methods, distributed and sold at a reasonable profit in bulk quantities at a price of about 3d. per therm, the difference is alarming. And the question of the selling price of gas so affects the foundry industry that it seems important that an investigation should be made of these modern methods of gas manufacture.

Normal Method of Gas Making.

The usual method of producing coal gas is, of course, by the direct heating of coal in some form of retort. In the older and more usual method the coal is heated to a high temperature, 850-1,100 deg. C. This gives the maximum volume of gas of a calorific value of 530 to 600 B.T.U. per cub. ft. and a fairly high yield of ammonia. On the other hand the coke produced is practically free from volatile matter, and is therefore not very suitable for use as a domestic fuel, as it is difficult to ignite. The light oil and tar have been subjected to such high temperatures before they escape from the retort that they are largely decomposed, partly into simple hydrocarbon gases, carbon and hydrocarbon and so swell the yield of gas from the coke, and partly into aromatic compounds, some of which are very valuable and others, such as naphthaline, which cause trouble in the distribution of the gas through the difficulty of their complete condensation.

Of recent years the carbonisation of coal at a much lower temperature has been widely investigated in the search for smokeless fuel for domestic use, and for a means of obtaining a liquid fuel from coal which would replace some of our imports of petroleum products. By the distillation of coal at a temperature several hundred degrees below that normally employed, a very much smaller yield of gas is obtainable than by the older method, but this gas is of particularly rich quality, having a calorific value of 700 to 900 B.T.U. per cub. ft.; this high value is largely due to the gases first formed from the distillation of the coal escaping from the retort without being subjected to a very high temperature which would cause their partial decomposition into a larger volume of gas with lower calorific value. The yield of light oil and tar is also increased from the same cause. The coke which is left in the retorts contains a proportion of volatile matter, and can therefore be ignited more easily, and if a correct coal has been selected for distillation, the coke is suitable for domestic purposes.

* Mr. Storey is a director of the Storey Foundry Co., Ltd., of Stockport.

Gas Production for Works Consumption.

If carbon is burnt in a limited amount of air, the carbon dioxide formed in the lower part of the fire reacts with the hot carbon in the upper part

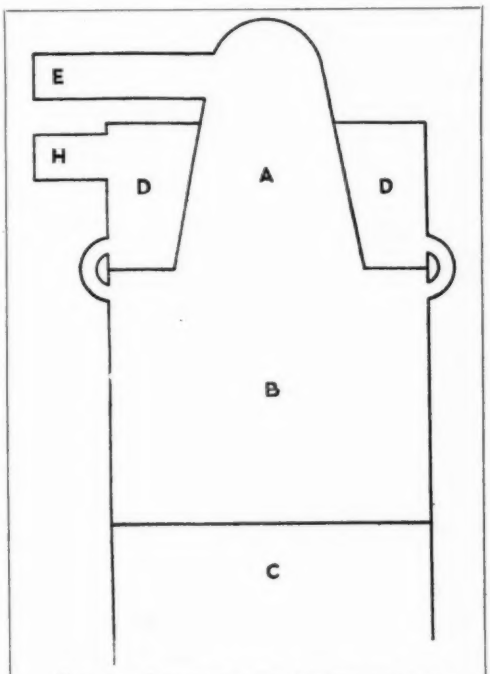


FIG. 1.—DIAGRAMMATIC SKETCH OF THE NUNEATON GAS PRODUCING INSTALLATION.

to form carbon monoxide with the absorption of a certain amount of heat. The gas which escapes from the top of the fire is a mixture of carbon monoxide with the unchanged nitrogen from the air admitted to the bottom of the fire. This nitrogen forms such a large proportion of the gas that the calorific value is very small, only about 110 B.T.U. per cub. ft. Various other disadvantages of this extremely simple method of gasification have necessitated the modification of this process by the introduction of steam at the bottom of the fire. This reacts with the hot fuel and forms hydrogen and carbon monoxide, and as this reaction absorbs heat it cools the fire and prevents trouble from the fusion of the ash from the coal. As it decreases the amount of air used per pound of coal gasified, the proportion of nitrogen in the resulting gas is decreased, and its calorific value is raised to 130-160 B.T.U. per cub. ft., the exact amount depending on the proportion of steam admitted.

Water Gas.

A further method of gas production is that in which a mixture of carbon monoxide and hydrogen

is formed by blowing steam through red hot coke. The reaction absorbs the heat, and after a short time the temperature of the coke has to be increased by blowing air through the fire. The producer gas thus formed is not collected with the carbon monoxide hydrogen mixture (which is known as blue water gas), but is used for other purposes, and the blue water gas therefore contains very small amounts of nitrogen, and has a calorific value of about 300 B.T.U. per cub. ft. A further enrichment of this blue water gas can be effected by passing it through a chamber previously heated by the waste producer gas into which oil has been sprayed, the oil is decomposed into simpler gases and the resulting mixture has a heating value of 480 B.T.U. per cub. ft. This "carburetted water gas" is extensively used in the gas industry, and it is stated that in the United States something like half the gas sold by public companies consists of this mixture.

The New Method.

The method of gas manufacture which has been developed at Nuneaton appears, from an inspection of the patents which apply to it, to consist of a combination of a gas producer with a low-temperature carbonisation apparatus.

Shown diagrammatically, A is a bell-shaped retort, into which coal is fed from the top. B is the space which acts as the producer. C is the space under the grate bars of the producer, into which air and steam can be admitted as desired. When gas is being made the space B is filled with red-hot coke; when air and steam are admitted to the space C, the hot producer gas formed can be withdrawn through the space D, which surrounds the retort in which space the producer gas, or a proportion of it, can, if desired, be burnt to heat up further the coal in the retort A. As the volatile matters in the coal are distilled off, and the coke in the producer B is consumed, the coke formed in the retort gradually descends into the producer and is continually replaced with fresh coal fed in through the top of the retort.

The chief advantages of this method seem to be as follows:—

(1) The coal used is completely gasified, only the ash it contains being left.

(2) Almost any coal can be used, as long as it is not of a too highly coking quality. With the ordinary methods of carbonisation only a limited number of coals are of suitable composition, and frequently the coal most easily available to the gas works cannot be used owing to the low percentage of volatile constituents it contains. With the method just described a high proportion of the heating value of the coal can be obtained in the form of gas, though its exact thermal value varies, of course, with the amount of volatile constituents in the coal.

(3) The method is a continuous one, and the apparatus is simple and easily kept in repair. Its first cost is so low that it does not exceed the cost of repairs and maintenance to the older type of apparatus of similar output for one year.

(4) The gas which is drawn from the retort contains all the valuable liquifiable distillation products, such as light oil and tar. This gas is comparatively small in volume and it is not a difficult matter to cool this volume of gas in order to get these liquid products. As they have not been subjected to a high temperature, the liquids contain large proportions of the products which are quite suitable for motor fuel, and little or no naphthalene which is an undesirable product.

(5) We are not aware what is the thermal value of the gas which is obtained by mixing the two products, producer gas and rich gas from the retort, but any heat required in the gas works itself can be obtained by burning the low-grade producer gas.

(6) A further very considerable advantage which is claimed for the gas produced in this way is not so simply described. Briefly it is that the ordinary gas of fairly high calorific value needs more primary air for complete combustion than its kinetic energy on issuing from the nipple of the burner is able to draw through the primary air holes in the burner. The lower-grade gas made by this process does not need so much air for complete combustion, and it can therefore draw in as primary air a very much larger proportion of its needs, even though its pressure in the supply pipe is no more than that of the ordinary supply. More efficient combustion is thus obtained, and in most cases a volume of low-grade gas will give, if burnt under the correct conditions, equivalent heating results to those given by the same volume of high-grade gas, and containing less heat units. Possibly this might not apply in every use, but it certainly seems to apply in most domestic cases of cooking and heating.

There appears to be another patent concerned in which coal gas, producer gas, and blue-water gas are made and mixed together in one plant, allowing a quality to be made of about 250 B.T.U. per cub. ft., but whether this plant is in operation or not the author does not know.

The net result of these advantages is that gas of a less calorific value than that usually supplied is being manufactured in Nuneaton, costing about 2d. per therm, and it is claimed such gas can now be sold in quantities under 4d., as against an average for the country of 1s. per therm. This is not being done by a corporation which could in any way, directly or indirectly, be subsidised from the rates, but by a limited company which is presumably in business for the purpose of making profits.

The question then remains:—When are the other suppliers of gas going to follow Nuneaton's example? We users of gas are not specially interested in how gas is made; what we do want, and must make every effort to obtain if we are to compete on equal terms with the rest of the world, is gas at 4d. per therm or 3d. if we can get it.

Shipping, Engineering and Machinery Exhibition.

A Representative Display.

The Shipping Engineering and Machinery Exhibition, which is to be open at Olympia from September 8th to 24th is now entering its final stages.

Individual exhibitors have for the most part perfected their arrangements and the exhibits will show a great advance on anything which has been seen in public up to the present time.

Amongst the exhibits of interest to foundrymen one notes:—Paints and compositions, furnaces, internal-combustion engines of all types, pipe-binding machines, centrifugal castings, gas engines, cooking stoves, metallurgy, switch gear, cutting and welding by all methods, metal shears, photo printing plant, pumps of many types, interpenetration of metals, pyrometers and scientific apparatus of all types, wrenches, spanners, helmets, spraying machines, telephones, steel shutters, air compressors, water turbines, business systems, belt dressings, petrol trucks, electric trucks, CO recorders, stainless steels and irons in castings, packings, jointings, pulley blocks, oil fuel burners, oils, portable electric tools, machine tools, chain drives, rubber in all its industrial applications, belt fasteners, engineers' tools, X-Ray apparatus, piston rings, monel metal, heat-resisting steels, varnishes, paints and enamels, white and yellow metals, ladders, trucks, etc., screw-cutting machines, pig-iron, nibbling machines, water softeners, condenser tubes, copper tubing, ingots, shearing and plate-cutting machines, electrodes, pneumatic tools, lifting magnets and valves.

The demand for tickets and official catalogues is already on a larger scale than at previous Exhibitions, and notification has reached the organisers of a great number of overseas visitors who are making the journey to this country specially to visit the Exhibition. Not only is every inch of ground-floor space booked, but the galleries will contain working exhibits of many classes of engineering plant. Cheap tickets are obtainable for works or office visits.

Barnett Bros. (Lambeth), Limited, Kinaston Works, Oakley Street, Lambeth, S.E.1.—Capital £10,000 in 9,806 "A" ordinary shares of £1 and 4,000 "B" ordinary shares of 1s. Metal merchants. Directors: E. G. Barnett, F. Barnett, E. W. Barnett, and F. R. Wettern.

Pointers on Steam-Engine Cylinder Practice.

Mr. A. S. Beech (who is also a member of the Association Technique de Fonderie de France) presented the Paper*, in the absence of the author, and conveyed from the French Association good wishes for the success of the Conference.

Referring to the details given in the Paper as to the melting of the metals, used for cylinders and piston rings, in the cupolas, Mr. Beech pointed to the statement that, all the conditions being observed, the pressure of the air blown into the cupola would be about 35 to 40 cm. (14 to 16 ins.), and said he presumed that in this case the author was referring to water pressure. With regard to the methods of manufacture adopted in France and Belgium, as mentioned in the Paper, he said the particular point which appealed to him was that the cylinders were cast vertically in France and Belgium, but were cast on the flat in Great Britain. He personally had seen many examples of the successful results obtained by slow pouring, and it would appear that Monsieur Audo was somewhat in agreement with Monsieur Ronceray in this matter. Finally, Mr. Beech commented that the supervision of manufacture seemed to be fairly thorough.

Errors from the "Fremont" Test

Mr. John Shaw said that the value of the author's description of his method of cylinder production was enhanced by his statement of the machining methods, and, to a still greater extent, by the wear figures given at the end of the Paper. The Paper was valuable in enabling those concerned with cylinder production in this country to compare their methods and results with those of Monsieur Audo, which comparison would benefit all. Discussing the author's remarks as to his recent use of the "Fremont" shearing and bending test, Mr. Shaw said that its chief advocates had put forward as one of the merits of this new test that it was so much more reliable than the tensile test, the specimen in the latter case being subject to want of alignment in the machine; yet in the Paper it was found that the tensile results were being used to build up the data from the "Fremont" machine. There were a number of grave objections to this test, of which the small size of the bar, 0.222 in., with its multiplication of any slight error, was not the least. Also, he noted that the tests were not taken from holes drilled out of the casting, but from projections cast on the surface of the casting, and he asked if the author could give some idea of the size of these bars, say, on a cylinder varying from 1 in. to 2 ins. in different parts.

Wear and Hardness Said to be Different.

Mr. F. J. Cook (Past-President) said that in some respects the experience of the author in the making of cylinders for steam locomotives was contrary to his own experience in the production of cylinders for stationary steam engines. The author had paid very special attention to hardness as shown by the Brinell test as being a measure of wearability, but he himself believed that anyone who had tried to get some co-relation between hardness and wearability would come to the conclusion that there was no relation *per se* between the two. He assured his hearers that he could make an iron as hard as one could wish for, but which would not wear at all well, and another which was as soft as possible but which would give the opposite result. The question of wearability was quite an interesting one, and a great many people would be very pleased to find a reliable test. In his view the author was paying too much attention to the Brinell hardness as a measure of wearability, and he believed it was generally agreed that for thick castings, such as locomotive cylinders, the Brinell hardness test was not a reliable test from any point of view. It was his experience that the drill method would give a very much better and more reliable indication of the nature of the casting as to general hardness and wearability than would the Brinell hardness test, whilst the tensile test was also a good guide for wearability. It appeared also that the author had struck a fallacy with regard to the soft ring in the hard cylinder. It looked very feasible, and it was quite a good talking point to say that it was better to wear the ring than the cylinder, the ring being much more easily reproduced than the cylinder itself. His own experience, however—and he had dealt with many thousands of cylinders—was that one should not aim at getting either of the items to wear, because if one set up wear in a soft piston ring it did not stop there; the cylinder also would wear.

Cylinders and Rings Better of Similar Composition.

The old adage about casting the piston rings out of the same pot as the cylinder was a very wise one, and it was his experience that if the piston ring were made out of the same metal as the cylinder very good results were obtained. That experienced had been gained after running many thousands of cylinders, with very high superheats, high piston speeds and high pressures, and in many instances without any lubrication of any description in the high-pressure cylinder. It was desirable to have a metal which would very quickly attain a very high polish on the surface, because that tended to give very good wearing qualities. For this purpose a liberal amount of pearlite seemed to be very good, but he preferred to have, not a full pearlitic structure, but rather, somewhat on the lines of white bearing metals, where one had hard spots interspersed in a soft matrix. One heard of cylinders made in the old days which had given wonderful results from the point of view of wearability, but the analyses were not startling, except that they showed the metal to be of poor quality. In the old days it was not unusual to run the engines very slowly on no load with saturated steam, with a liberal amount of lubricant, for long periods; he knew of cylinders which were running for six weeks, with the result that a hard skin was produced, giving good wearability, even with the commoner kinds of metals. Nowadays, however, an engine of perhaps 1,000 h.p., with very high superheats, was put on to the test plate, turned round a few times by hand in order to see that all was clear, and then put straight on to full load. If one used some of the poor metals, such as were used in the old days, under those conditions, one would find that the working results were not what they appeared to be from the earlier results. Finally, Mr. Cook asked if the author would give the ultimate life of the cylinders made by the Paris-Orleans Railway Company.

Influence of Cooling Conditions.

Mr. W. H. Poole asked whether Mr. Cook, in advocating the use of the same metal for both the cylinder and the piston ring, had taken into account the cooling conditions.

Mr. Cook said he should have pointed out that the cylinders he had referred to were thick, and that the piston rings were also relatively thick, although not so thick as the cylinders themselves, but the cooling action was slow enough not to influence unduly the relative hardness. He had had experience of many thousands of cylinders and rings, which proved that the suggested system would give good results.

Fallacy of Correlating Formula.

Mr. J. G. Pearce (Director, British Cast Iron Research Association) said that the significance of the Δ in the formula on p. 16 of the Paper was not specifically stated. Presumably it referred to Brinell hardness. Various Continental workers, notably Portevin and Schuz, had advanced formulæ connecting Brinell hardness and tensile strength, but these formulæ had not been found reliable for cast iron when tested by results obtained in this country. Did the results given in Fig. 11 represent the whole of the experimental data obtained for the construction of the formulæ? If not, references to detailed publications of the results would be appreciated. As Mr. Shaw had pointed out, it was a little inconsistent to advocate the shearing test on account

* "The Making of Steam Engine Cylinders," by M. Audo.

of the deficiencies of the tensile test, and then to use a formula for converting the one to the other. So far as was known, shearing-test figures had not been obtained in this country, so that the first formula on p. 16 could not be criticised, but it was hoped to do this shortly.

Effect of Small Changes in Composition.

Mr. Horace J. Young, F.I.C., in a written communication, asked whether the compositions of the metals used by the Paris-Orleans Railway Company for cylinders and piston rings, as given in the Paper, referred to metals in the actual castings as used on the locomotives. He had noted that the cylinders and the piston rings were alike in all else save that the rings had 0.3 per cent. more carbon and 0.2 per cent. more silicon. It would appear difficult to control these compositions, so that the total carbon contents were 3 per cent. in the one and 3.3 per cent. in the other. Moreover, it was not clear to him why the piston rings should have more carbon than the cylinders. Theoretically it might appear that, therefore, the piston rings would have more graphite flakes, but there had been little proof in practice that low-carbon irons were better wearing, or, at any rate, that there was any advantage to be gained by such small differences as would be practicable under the specifications set out by the author. In another part of the Paper the author had claimed a recarburisation of only 0.05 per cent. with carbon content of 3 per cent. Did this mean that when he charged into the cupola irons containing a total of 3 per cent. of carbon he obtained from the cupola a cast iron containing only 3.05 per cent.? The author had unusual facilities for ascertaining the effect of various elements upon the wearing properties of cast iron. Suppose he took irons all of the same hardness, and differing only in one constituent, would he find that an iron containing 0.05 per cent. of sulphur would be different from one containing 0.15 per cent.; or that one containing 0.65 per cent. of manganese would be different from one containing 1.15 per cent.; or that one with 3 per cent. of carbon would be different from one with 3.3 per cent.? These points were vital: we were uncertain of ourselves when it came down to definite figures and single comparisons of this nature, and he felt sure that if the author would be good enough to give his experience it would be appreciated.

Limits of Composition Sought.

Mr. W. H. Poole, referring to the fact that the phosphorus content of the metals used by the author was 0.2 per cent., asked whether there was any advantage to be gained by such a low phosphorus content as against 0.6 or 0.8 per cent. The general practice in this country was to have a low phosphorus content. He asked for information as to the relation between phosphorus content and wear, and carbon content and wear, and also, whether the author aimed at a particular limit of the combined carbon.

Mr. Colin Gresty (Newcastle Branch), commenting on Mr. Cook's remarks as to wearability, and the question of whether or not the pearlitic structure gave the best wearing properties, referred to a paper read recently in Germany by Lehmann, which supported Mr. Cook's statement that Brinell hardness and wearability were not related at all. The same worker had proved that irons with a pearlitic structure gave the best wearing qualities, which was in accordance with his (Mr. Gresty's) experience.

Mr. Cook said he had read the Paper, but in his view it was a question of degree. One could find plenty of cases in which, for wearability, one did require a pearlitic structure. He had not had experience with a wholly pearlitic structure, but he aimed at a pearlitic structure as a ground work, with probably more cementite than was usually accepted by the wholly pearlitic structure people, for the reason he had stated, namely, that as with white metals where one had a more or less soft matrix with harder spots in it the best results were obtained from a wearing point of view.

Mr. E. Longden, after remarking that the discussion had emphasised the complex nature of cast iron, said that the phosphorus content of the metal used by Monsieur Audo had reminded him of an experience of his some years ago, when he was making heavy gas engines. For years the company making these engines had employed a No. 4 Derbyshire iron, with a silicon content of 2.68, and a phosphorus content of just over 1 per cent., and they had never heard of any trouble being experienced. An inspector had then specified what was considered to be a better analysis, the phosphorus content being low, but that metal had less wearing qualities than had the No. 4 Derbyshire iron previously used.

Centrifugal Cast Liners and Piston Rings.

The President, dealing with the question of the hardness of cylinder liners and piston rings, as referred to by Mr. Cook, said that whilst he would not attempt to dispute Mr. Cook's word, he would like to allay any misapprehension which might arise. He assumed that Mr. Cook had in mind casting in the usual way in green or dry-sand moulds.

Mr. Cook said that the casting was made in dry sand.

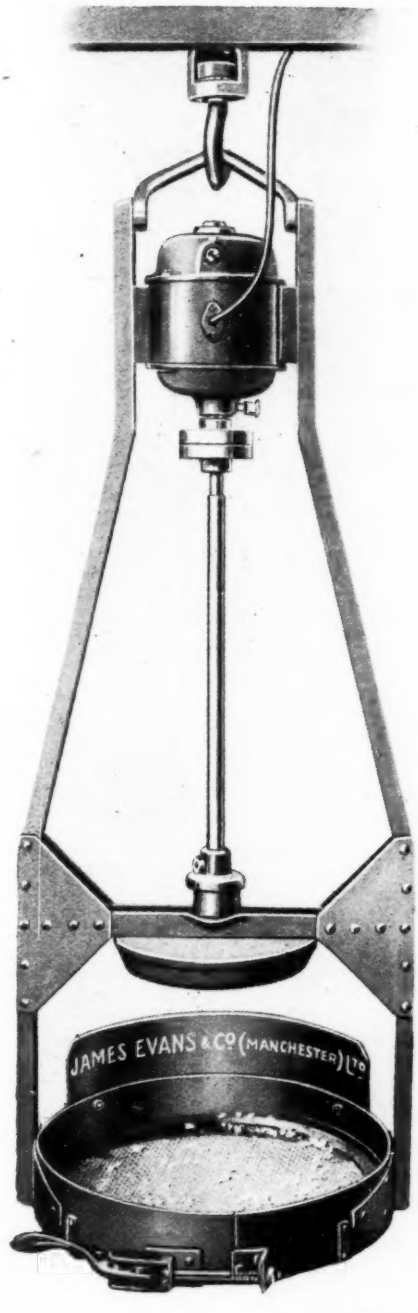
The President emphasised that rings made by the centrifugal process should be considered apart from sand cast rings. The question as to whether a pearlitic structure is desirable in a centrifugal casting is a very debatable one, and he felt that a great deal of information had yet to be gained in regard to centrifugal casting. Certainly, from practical experience at his works, together with the information available in many of the technical journals, led him to believe that centrifugal casting for cylinder liners and piston rings had a great future. He felt that further information had been gained from the results of actual industrial applications, and that he could assure his hearers that we were only on the fringe of its uses yet. He hoped that some day they would be able to say that they had data which was standard data and embraced the results of tests under most conditions likely to be met in service, and that he would have an opportunity of placing it before members of the Institute.

Importance of Weights of Bearings Emphasised.

Professor T. Turner (Late Professor of Metallurgy at Birmingham University, and Past-President of the Institute of Metals), discussing the relation between Brinell hardness and wearing properties, said that one knew, of course, that metal which was extremely soft did not grind away so readily as a harder metal. From the general use of bearing metals we had learned something with regard to wear, and the same factors might be applied to cast iron. For some purposes one might use an expensive Babbit metal, rich in tin, and in some cases one might get better wearing properties with a metal costing about a quarter as much, having a lead base. It depended to a considerable extent on the weight the bearing had to stand, *i.e.*, the pressure per sq. in., and the speed. These again affected the temperature. With regard to the wear of cast iron, he said that for some purposes a soft, non-pearlitic iron—a highly graphitic iron—would give very admirable wearing properties, as, for example, in the case of the old large reciprocating engines. There was a certain smoothing effect, due to the large flakes of graphite, and no doubt there was produced what we had been in the habit of perhaps mis-calling an "amorphous" material, as a coating on the inner surface of the cylinder. In other cases, where the pressure was greater or where the temperature was higher, one might require to use another kind of cast iron. He suggested that, while it could be accepted as proved that the Brinell hardness test did not necessarily indicate the wearing properties of the cast iron, the question of the kind of cast iron which would wear best would depend to a considerable extent upon the conditions of the service of the specimen.

Mr. J. E. Fletcher (Consultant, British Cast Iron Research Association), as one who had had experience in the measurement of the effects of both engine cylinder and rolling mill journal friction, associated himself with Professor Turner's remarks, and drew attention to the difference there was in the type of wear, say, in rolling mill roll-neck, when running in a cast-iron bearing, which had sometimes been tried, as was illustrated

EVANS'S ELECTRIC
GYRATORY FOUNDRY RIDDLE



THE saving accomplished by the use of our Electric Gyratory Riddle pays for the cost of the machine in a few weeks' time.

It will sift more sand with one operator than six men sifting by hand. In addition to this it mixes the sand better, and produces a better grade than hand labour.

The machine is portable and may be moved to any place in a few moments (where a hook for suspension is available and electric current in service) and set in motion instantly.

Motor and working parts are all above the sieve, thus preventing the sand from interfering with the operation of the machine.

Power required, ½ B.H.P.

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BRITANNIA WORKS,

BLACKFRIARS, MANCHESTER.

by the older engines, and in that of a steam-engine cylinder. He had taken some of the old cast-iron shafts out of rolling mills after they had been at work for many years. There seemed to be a closer connection between Brinell hardness and the wearing properties in a revolving piece in a journal than in, say, a piston ring and a cylinder; there was a difference between the resistance from revolving friction and sliding friction when compared with Brinell hardness values. Commenting on the difference between the methods of casting cylinders, particularly the modern form of locomotive cylinders, in this country and on the Continent, he said that founders needed carefully to study that question, because there was a very great difference between the way in which the molten metal rose in the mould, producing different types of structure in the bottom and the top of the casting, and one must view that in the light of vertical and horizontal casting methods. The British Cast Iron Research Association had found some rather curious structural differences in the cast iron, in the cases of cylinders cast horizontally and those cast vertically, due to differences in the rate of pouring and cooling.

Engineering Advertising.

In the course of a paper read by Mr. Frank E. Dadd, at the Advertising Exhibition and Convention at Olympia, he pointed out that advertising could help the manufacturers of engineering products to recover some of the trade unavoidably lost whilst they were concentrating all their efforts on the production of munitions during the war. It could help them to open up fresh markets. Considering the success that advertising had achieved in other industries, it was truly remarkable how very little British engineering firms as a whole realised the possibilities of this wonderful selling force. There were some brilliant exceptions, and others were following in their footsteps, but the great majority quite evidently did not as yet appreciate the power of the force that lay ready to their hand. Very large sums were expended every year by the British engineering industry on advertising, and there was not the slightest doubt that for the same expenditure much better results could be achieved. If anyone doubted that British engineering advertisement was capable of improvement, let him study the advertisements in the technical press with an impartial mind. One would find that in nine cases out of ten, the advertisements were both uninteresting and uninformative; they contained no news value whatsoever, but confined themselves to an illustration of a piece of machinery together with some very general and vague claims, such as "High efficient," "Low-power consumption," etc. (non-committal phrases that had no selling value), and finally the name of the makers very large. These were really not advertisments—they were only announcements, and the chief value they had was known to advertising men as "Reminder" advertising. Here and there one would find a brilliant exception where some very interesting industrial operation was described, or some very useful service explained in an interesting manner. Facts, no vague promises, were given in these advertisements and they had selling value accordingly. The speaker said he could name half a dozen British engineering firms who were putting out this kind of advertising. There was really no need to name them; their advertising stood out so prominently from the very uninteresting trade cards that surround them. Were British engineering advertising all conducted on these lines, he (Mr. Dadd) was convinced that we should no longer find advertising regarded as an expenditure, almost an extravagance, that should be ruthlessly pruned during times of trade depression. After all, it did seem illogical to refrain from telling people what one's goods would do at the very time when one was in the greatest need of fresh customers.

United States Steel Corporation.—A cable from New York states that the Federal Trade Commission has decided to investigate the financial relationship between the United States Steel Corporation, General Motors, and the E. I. Dupont de Nemours Company. This action follows the recent publication of the Dupont Company's half-yearly report, in which it was disclosed that the Company had acquired 114,000 common shares of the United States Steel Corporation, in addition to possessing 1,996,244 common shares of General Motors. The Trade Commission's official statement says that the establishment of a community of interest among three of the largest corporations of their kind is a matter of public concern, and an inquiry will be made as to the probable economic consequences of such a condition.

Metallurgical Contribution to the Development of Motor Vehicles.

At the Summer Meeting of the Institution of Mechanical Engineers, held at Birmingham recently, Mr. H. Kerr Thomas, of the Bean Motor Works, Dudley, read a Paper entitled "The Effects of the Automobile Industry on the Midlands." The metallurgist, he said, owed his importance largely to the motor industry. With the advent of the motor car the designer was faced with the necessity of reducing weight, and thus had to seek from the steel-maker material which would possess the necessary strength to permit of the cross-sections being greatly reduced. Arising from this need, an unprecedented demand sprang up for alloy steels which could be obtained as a standard product at reasonable prices, and in contrast with the low-carbon steel with which the older mechanical engineers had worked for so many years, they now had nickel, chromium, vanadium, cobalt, silicon, manganese, and molybdenum alloys in daily use.

Generally speaking, the use of alloy steels, until the commencement of the present century and apart from armament purposes, was confined to the manufacture of cutting tools, and hardening these in a blacksmith's fire constituted the only heat treatment then practised. The result of the change had necessitated the incorporation of the complicated processes of heat treatment in everyday shop practice, without which the advantage of the finer steels would be missed.

The great development in aluminium manufacture was also attributed to the requirements of the motor car. While alloy steels had been developed on account of their strength and powers of resistance, aluminium had been in demand because, while it did not exhibit in its original condition any very great strength, it nevertheless formed, within certain limits, a reliable material which could be substituted for cast iron, of which it was not more than one-third the weight. In the last thirty-five years, which comprised the existence of the motor vehicle, the world's production had grown to an annual output of 150,000 tons, and this figure was constantly being increased. Approximately two-thirds of this was consumed to-day in the motor-car industry, while of the remaining one-third about one-half was used for electrical purposes.

In recent years, in response to the ever-growing demand for lightness and increased engine speeds, alloys of aluminium had been developed which were capable of being forged; and, in the form of duralumin and similar alloys, which could be stamped into intricate sections and which possessed high specific strength. The metal was in constant demand for connecting rods and similar parts; moreover, these alloys were amenable to heat treatment, and their powers of resistance were increased by this means.

Examination of Chemical Engineers.

The Institute of Chemical Engineers have set a very high standard for the examination for the admission of associate members. Quite a large proportion of the questions deal with metallurgical subjects, such as welding, corrosion and containers for acids. The Papers are well balanced and if the marking is severe, then employers can rest assured that successful candidates are at least technically well equipped to take charge of a department in a firm of chemical engineers.

Important—Change of Address.

The French foundry technical society—Association Technique de Fonderie—has changed its address from 15, rue Bleue, to the Ecole d'Arts-et-Métiers, 151, Boulevard de l'Hôpital, Paris 13.

Works Committees.

In the current issue of "Industrial Welfare," Mr. E. J. Fox, the managing director of the Stanton Ironworks Company, Limited, describes in detail the efficient welfare organisation for which the Stanton organisation is famous. Typical sets of rules are given for the conduct of works committees.

ALUMINIUM ALLOYS
B.E.S.A. Standards

(Part of) Aluminium Data Sheet A 121

Specification No.	Specified Chemical Composition.[1]	Description.	Minimum Tensile Properties.[2] Ultimate tens. str. Tons sq. in.	Per cent. elongation in 2 in.
3L11	*Copper* 6% to 8% *Tin* may be used up to 1% ...	Casting alloy	9	3
2L8	*Copper* 11% to 13% ...	Casting alloy	9	Nil
2L5	*Zinc* 12.5% to 14.5% *Copper* 2.5% to 3.0% ...	Casting alloy	11	3
L24	*Copper* 3.5% to 4.5% *Nickel* 1.8% to 2.3% *Magnesium* 1.2% to 1.7%	"Y" alloy castings	11	Nil

[1] In each of the above alloys the remainder consists of aluminium and normal impurities.
[2] Tensile tests for casting-alloys are made on specimens machined to .564 in. diameter from samples cast 1 in. diameter in a heated iron chill. Tensile tests for sheet are made on stamped specimens with width ½in. to 1½ in., and parallel length 2¼ in.

F.T.J. 18/6/27.

Weight saving and aluminium are synonymous. So every engineer knows. When it is to be decided who shall mix the alloys, there's a choice between ready-mixed

Aluminium Alloys

B.E.S.A. or B.A. Co., and the virgin B.A. Co. notched bars.

THE BRITISH ALUMINIUM CO., LTD.,
ALUMINIUM PRODUCERS,
ADELAIDE HOUSE - LONDON, E.C.4.

GANISTER, CUPOLA BLOCKS, FIRE BRICKS, FIRE CLAY.

Silica Bricks, Tuyeres, Stoppers, Nozzles, &c.

STEEL MOULDERS' COMPOSITION, SILICA CEMENT.

J. GRAYSON LOWOOD & Co., Ltd.
DEEPCAR, Nr. SHEFFIELD.

Telegrams: "LOWOOD, DEEPCAR."

TEAM BY-PRODUCT COKE CO., LTD.
DUNSTON-on-TYNE
"TEAM" PATENT COKE
SPECIAL FOUNDRY QUALITY

FOR PRICE AND PARTICULARS APPLY TO:—
ALEXANDER LEITH & CO.,
25, COLLINGWOOD STREET,
NEWCASTLE-ON-TYNE.

TYPICAL ANALYSIS (*if necessary guaranteed*)
ASH not exceeding 8%
SULPHUR " " 0.8%
VOLATILE " " 1 %
MOISTURE under 1.50%

Trade Talk.

IN FUTURE the business of Norman Pearson & Company, Limited, will be carried on by the Thames Tube and Fittings Company (Great Britain), Limited, Crown Works, Lots Road, London, S.W.10, which has been formed for that purpose. The late management of Norman Pearson & Company, Limited, Mr. E. L. F. Archdeacon and Mr. G. W. Hammond, will act as managing director and sales manager respectively of this company.

IN ORDER TO give two more delegates an opportunity of attending the forthcoming Empire Mining and Metallurgical Congress in Canada, Sir Robert Hadfield placed two travelling scholarships at the disposal of the Iron and Steel Institute and the Institution of Mining and Metallurgy. The former have nominated Miss C. F. Elam, and the latter Professor Bernard W. Holman, both assistants to Professor H. C. H. Carpenter at the Royal School of Mines, South Kensington, and on July 25 they paid a visit to East Hecla Works.

DURING JULY twenty craft measuring 20,319 tons were put into the water in the Clyde. The previous month the production was nearly double—25 vessels of 40,515 tons. In July of last year, when the full effects of the coal dispute were beginning to be experienced, 12 vessels of 12,897 tons were launched, while the corresponding month of 1925 was represented by 34 vessels of 30,931 tons. For the seven months to date the output is 115 vessels, aggregating 165,470 tons; that of the corresponding months of 1926, 87 vessels of 170,720 tons; and of the corresponding period of 1925, 153 vessels measuring 333,888 tons. In keeping with the comparatively low output, the number of new contracts reported during the month were few. A. McMillan & Son, Dumbarton, were commissioned to build a motor ship of about 7,300 tons deadweight for MacIver & Co., Liverpool; the Ailsa Shipbuilding Company, Ayr, a single-screw coasting steamer for British owners; the Clyde Shipbuilding and Engineering Company, Port-Glasgow, a small coasting steamer for Australian owners, and Alley & MacMellan, Polmadie, two lighters, each 125 feet in length, for owners whose names have not been made public.

A FEELING of considerable uneasiness prevails regarding the future of the tin market. Quite recently an attempt was made to corner the metal, and it is stated that the attempt was made by interests which are not entirely unconnected with the London Stock Exchange. The position built up to support the corner has been largely liquidated, but it is still maintained in various quarters that the price of cash tin is being artificially supported. It is claimed that the irregularity of the price at present is due to efforts made to bolster up the position. Some dealers in the market declared that the quotation will be considerably lower than at present when the present speculative position has been entirely cleared. Others claim that the current market value of the spot metal is entirely warranted on the present statistical position. Production is increasing a little, and the consumptive demand is falling off as usual at this season of the year, but despite such facts it is maintained that tin at its present market value represents the actual position. The share market is naturally in a most undecided state. Several small reactions were seen in share values lately, but it must be realised that for the moment scarcely sufficient business is passing to actually test quotations. Under the circumstances an erratic market for tin shares is to be expected.

Gazette.

A MEETING OF the creditors of the Kryn and Lahy Metal Works, Limited, of Letchworth, was held on July 28 in London. Mr. A. E. Tilley, of Singleton, Fabian & Company, occupied the chair, and reported that he had been appointed to act as receiver for the first debenture-holder, and as the liquidator in the voluntary liquidation. The ranking liabilities were £231,915. According to the books the assets totalled £184,045, but they were subject to preferential claims of £2,995, and debentures and interest of £32,446. The net assets, therefore, were £148,604, or a deficiency of £133,310, so far as the creditors were concerned. The company was registered in March, 1915, with a nominal capital of £100,000, and £71,995 was issued for cash. The present position of the company was attributed to the ravages of excess profits duty, the disastrous results following the strike last year, and lack of working capital. The opinion was expressed that the voluntary liquidation of the company should be continued, with Mr. Tilley as liquidator, assisted by a committee of the principal creditors.

Contracts Open.

Buenos Aires, October 5.—Pumping machinery and electric generating plant, for the Argentine National Sanitation Works. The Department of Overseas Trade, 35, Old Queen Street, S.W.1. (Ref. A.X. 4,996.)

Cairo, October 12.—Four internal-combustion Diesel alternator groups and accessories, for the Mechanical Department of the Public Works Ministry, Cairo. The Chief Inspecting Engineer, Egyptian Government, 41, Tothill Street, S.W.1. (Fee £1 1s. per set, non-returnable.)

London, E.C.4, August 17.—Body ironwork and fitting for carriages; 41¼-lb. rails and fishplates; fishbolts for 41¼-lb. F.F. rails; dogspikes for 41¼-lb. F.F. rails, for the Assam-Bengal Railway Company, Limited, Bishopsgate House, 80, Bishopsgate, E.C.2. (Fee £1 1s., non-returnable.)

Obituary.

We regret to announce the death of Professor Oberhoffer, the well-known German expert on the metallurgy of cast iron.

MR. J. MCNEIL died on July 28 at "Glenamod," Prestwick, Ayrshire, aged 81 years. He was a director of John McNeil & Company, Limited, Colonial Iron Works, Glasgow.

MR. W. F. NEWMAN, eldest son of the late Capt. W. Newman, St. Leonard's, Withernsea, has died following an operation. Mr. Newman was born in Australia, and in his early life was out in Brila, Roumania. His chief work was in China, where he represented British interests on behalf of over 20 engineering firms operating in that country. After the war he returned to China to reorganise the business of the firms he represented. Just before returning to his home in England for the last time he completed a tour of Australia on behalf of Thos. Firth & Sons, Limited, Sheffield, of which he was a director.

THE DEATH TOOK PLACE on July 30, at Haybridge Hall, Hadley, near Wellington, of Mr. James Patchett. He was chairman and managing director of the Shropshire Iron Company, Limited, chairman of the Hadley Trench and Wrockwardine Wood Lighting Company, Limited, director of the Union Steel Corporation (of South Africa) and of other companies. He was a large employer of labour in the manufacture of iron, steel, copper and bronze, a member of the Birmingham Iron Exchange, the Midland Iron and Steel Wages Board, the South Staffordshire Ironmasters' Association, and the Iron and Steel Wire Manufacturers' Association. Mr. Patchett received part of his education at Mason's College, Birmingham. He took up a partnership in the works at Hadley, and for many years up to his death had been the head of that concern.

Company Notes and News.

Head, Wrightson & Company, Limited.—Profits, £23,428; brought forward, £1,234; debenture interest, £6,750; dividend, 2½ per cent. on ordinary shares; carry forward, £1,514.

Manganese Bronze and Brass Company, Limited.—Brought forward, £9,884; adverse balance, £13,497; economies in administration and cost of production reduced loss to £3,613.

Richardsons, Westgarth & Company, Limited.—Brought in, £24,466; transfer from general reserve, £4,440; debit balance, £1,689; available, £27,217; debenture interest and directors' fees, £3,653; preference dividend for year to October 31, 1926, £21,000, provided from reserve; dividend on ordinary shares, 6 per cent. for year; carry forward, £2,564.

National Smelting Company, Limited.—Presiding at the ninth annual meeting, SIR ROBERT HORNE said that the main programme for equipment, on which half a million sterling had been spent in four years, had been completed during the year. The cost was in excess of the estimates, partly because of strikes, of labour troubles, and the delay caused in its completion. The works at Avonmouth and Swansea Vale had been equipped with mechanical blende roasting furnaces and sintering machines, and in both cases mechanical handling and special storage arrangements had been installed. Moreover, at Swansea Vale a new acid plant had been set up and two extra units of the Avonmouth plant had been brought into operation. Recent experiments indicated that material alterations were likely before long to become necessary in the processes dealing with spelter. Sir Robert added that the outlook to-day was favourable, and that, although he did not expect the current year's returns to reach the high level of last year, the works had given good results and the investment revenue was satisfactory.

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THERE IS NO FOUNDRYMAN IN THE COUNTRY

who has not, at times, felt the need of a handy supply of a fire-resisting cement which he could wet up and use for fixing a brick in its place, or filling a crack or mending a worn place

KNOWING

that it would quickly set hard like Portland Cement, and set only the harder both before and after the application of the most intense heat.

SUCH A CEMENT IS

"PYROLYTE"

a fine dry powder, packed in a drum—air and watertight. Please ask for booklet.

☛ **A sample cwt. 30/- nett, Carriage Paid** ☚

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THE GENERAL REFRACTORIES Co., Ltd.

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COMPANY MEETING.

INDUSTRIAL NEWSPAPERS, LIMITED.

Sir Arthur Lowes Dickinson, M.A., F.C.A., chairman of Industrial Newspapers, Limited, addressing the shareholders at the meeting held at the Holborn Restaurant on August 8, said: Before dealing with the accounts I must refer to the loss the company has sustained by the death of Mr. W. F. Eagland, one of the former proprietors of the IRON AND COAL TRADES REVIEW, and a director of this company, who has been most helpful in every way in promoting its welfare. The results for the fifteen months from the commencement of its business in April of last year to June 30 of this year are disappointing, but this is mainly, if not entirely, due to the disastrous effects of the strikes of last year, not only upon trade generally, but on the particular trades of iron, steel, coal and textiles, for which our chief publications cater.

In the second month of the company's trading the strike began and lasted, as you all know, for the rest of the year. It is satisfactory to be able to state that the results for the month of June last show that the losses due to the strike have now been made good, and that allowing for the factors still to be mentioned, the profits shown in the prospectus for the year 1925 are now being realised. From now on the business of the company should steadily progress.

It was anticipated that the normal increase of earnings under the new management, together with savings due to amalgamating the management of several publications, would have more than sufficed to meet the managing directors' salaries and expenses, as well as the directors' fees. These anticipations were brought to nought by the strikes. There are other factors militating against profits during the past year. One of our publications, "Rylands' Directory," only appears every second year, and no part of the profit thereon, which it is now known will exceed that previously earned, has been brought into the accounts of the past year. A reserve has had to be made against bad and doubtful debts, which are largely a relic of strike depression, and a proportion of the cost of the fitting out of our new offices has also been written off.

The directors, other than the managing directors, have drawn no fees, being largely interested in the second preference and ordinary shares of the company. Of the second preference share issue all but £25,000 were taken by the vendors in part payment of purchase money. In view of the serious effects of the strikes, the vendors agreed to cancel the cumulative dividend due to them as to June 30 last. Some of the vendors were trustees, and partly in view of this it was found necessary to call a meeting of second preference shareholders and pass the necessary resolutions for cancelling this dividend according to the provisions of the Articles of Association.

Moreover, the directors have given an undertaking that no dividend will be paid on the ordinary shares until an adequate reserve or carry forward of not less than £20,000 has been accumulated. The result of this transaction is to ensure due payment of the dividend on both classes of preference shares, as from July 1 last, and it will improve both the security and value of these shares.

Out of the profits of the period of nearly 17 months, to which the accounts relate, the full dividend has been paid on the first preference shares, and you will be asked to approve this dividend. The balance of £8,000 odd the directors propose to carry forward as a nucleus of the sum of £20,000 referred to above.

Turning from finance to business, I can give you a good account of the progress of our various publications in standing and reputation in the service of the trades which they represent.

The "Iron & Coal Trades Review."

The most important publication owned by the company is THE IRON AND COAL TRADES REVIEW. Founded just sixty years ago, it seems destined to become supreme in its sphere of technical trade journalism. It is encouraging to report that in spite of the serious difficulties that have beset the heavy industries during recent years, culminating in the disastrous strikes of last year, its prestige has never stood higher than it does to-day.

To commemorate the sixtieth anniversary of this journal, it is proposed to publish in the coming autumn a Diamond Jubilee Number, which will contain a complete record of achievement in the coal, iron and steel industries during the past 60 years. The preparation of this work is now in progress, and its ultimate success is assured by the fact that prominent industrialists, not only in the coal, iron and steel industries but in a number of allied trades, have cordially got together and lent their aid in the compiling of a volume that will be unique in the annals of trade journalism. The Diamond Jubilee Number of THE IRON AND COAL TRADES REVIEW will in every way be worthy of the occasion.

The policy which has been responsible for the past success of this important journal is being steadily pursued, and with the promised revival of the heavy industries the future is regarded with every confidence.

The "Foundry Trade Journal."

Despite the unparalleled depression common to all trades, and particularly, as I have said, in the industries for which this publication caters, the "Foundry Trade Journal" has retained its advertising revenue without any perceptible fluctuation throughout the whole period under review. Gratifying as this is, it has, of course, been difficult to make developments, as the energies of your staff have been occupied in preventing loss of revenue, which under happier circumstances could have been more profitably devoted to its increase.

The extremely close relationships which have been developed between the foundry industry and this newspaper have been strengthened by the successful service by its Editor as president of the leading technical association—the Institute of British Foundrymen.

Assuming that the effect of the tragedies of the past year is in some measure passing, it is proposed to enlarge the paper as from October 1 in such a manner that better service can be given both to readers and advertisers.

The "Coal Merchant and Shipper."

The "Coal Merchant and Shipper" can rightly claim to be the sole exponent of the retail coal trade, that much-criticised section of one of the principal staple industries of the country. It is the official journal of the Coal Merchants' Federation of Great Britain, whose members have been recently subjected to attacks on account of the scarcity of coal and the high prices charged therefor. While it is natural, perhaps, that the public should seek to blame for these conditions those with whom they come most in contact, it is unfair that the blame should be thrown entirely or even mainly on them. To overcome the present unfortunate conditions it is essential that all parties—owners, men, carriers and distributors—should work together and endeavour so to organise the industry that the public may get its coal at a reasonable price yielding a reasonable profit which is reasonably divided between producers and distributors. While mines and miners have been much in the public eye, the coal merchant has suffered, perhaps, from not making full use of the power of publicity to show that he is at least as upright and businesslike as any other section of the trading community, and only desires to receive a reasonable return for his capital outlay and risk.

A publicity scheme is now being organised by the coal trade with the active support of the "Coal Merchant and Shipper," working in the closest co-operation with the Coal Merchants' Federation of Great Britain, in order to answer the attacks that have been made upon them, and show that they are fully competent and fully prepared to do their part in restoring the whole industry to a prosperous condition.

"Ryland's."

That remarkable volume, "Ryland's Directory," which is published every two years, becomes due again on January 1. At the moment the indications are that this number will be well up to the usual standard, both as regards its editorial information and advertising revenue; in fact, there is already a slight increase in the latter over any previous issue.

The "Cotton and Wool Year Books" are published annually, but had to be compiled this year during the period of industrial depression following the strike, which certainly was not conducive to that hope in industry which encourages expenditure of money on advertising; nevertheless, they made their share of profit, and indications are that the new numbers due in January of next year will be well up to standard.

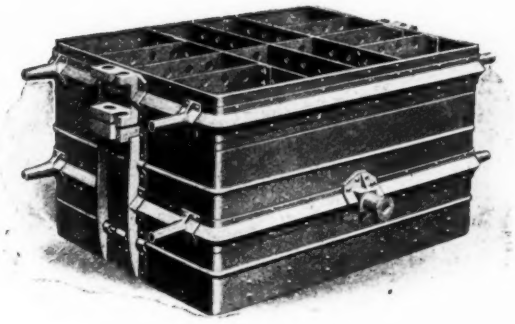
In concluding this review, I would say that the keynote of our policy in all these publications is service: service to our advertisers, service to our readers, and service to the community. As long as we continue to maintain and improve on our present standards, we may confidently expect to receive the fullest support of all our clientele. The value of advertising was never more highly rated than at present, and it is ever more and more realised that good and continuous and increasing advertising is one of the main roads to that prosperity upon which the country depends for its future.

STERLING BOXES

SPEED UP PRODUCTION

AND MAKE FOR

ALL ROUND EFFICIENCY IN THE FOUNDRY



Many hundreds of Sterling Boxes, as shown in the above illustration, have been supplied for the production of Cylinder Castings for MORRIS CARS. They are producing extremely accurate castings against rigid inspection and making them better, quicker and cheaper than ever before.

STERLING ROLLED STEEL MOULDING BOXES ARE MADE TO SUIT THE SPECIAL REQUIREMENTS OF EACH INDIVIDUAL FOUNDRY

HAVE YOUR MOULDING BOXES MADE BY THE LEADING MOULDING BOX SPECIALISTS

STERLING FOUNDRY SPECIALTIES LTD.
BEDFORD

London Office: 13, VICTORIA STREET, S.W.1

WEEKLY PRICE CURRENT.

COPPER.

	£	s.	d.
Standard cash	55	15	0
Three months	56	1	3
Electrolytic	62	15	0
Tough	59	10	0
Best selected	60	10	0
Sheets	86	0	0
India	72	0	0
Wire bars	62	10	0
Do. September	63	0	0
Do. October	63	0	0
Ingot bars	63	0	0
H.C. wire rods	67	5	0
Off. av. cash, July 54	11	8	5/8
Do. 3 mths. July 54	19	9	1/2
Do.,Sttlmnt. July 54	11	6	1/2
Do., Electro, July 60	6	6	1/2
Do., B.S., July 58	15	3	1/2
Aver. spot price copper, July 54	11	8	1/2
Do., wire bars, July 60	11	3	1/2
Solid drawn tubes		12	1/2d.
Brazed tubes		12	1/2d.
Wire		9	1/2d.

BRASS.

Solid drawn tubes	11 1/2d.
Brazed tubes	13 1/2d.
Rods, drawn	10 1/2d.
Rods, extd. or rlld.	7 1/2d.
Sheets to 10 w.g.	9 1/2d.
Wire	9 1/2d.
Rolled metal	9 1/2d.
Yellow metal rods	7 1/2d.
Do. 4 × 4 Squares	8d.
Do. 4 × 3 Sheets	8 1/2d.

TIN.

	£	s.	d.
Standard cash	297	0	0
Three months	288	10	0
English	294	0	0
Bars	295	15	0
Straits	301	15	0
Australian	301	15	0
Eastern	295	5	0
Banca	309	5	0
Off.avr.cash, July	288	16	3
Do., 3 mths., July	281	19	3 1/2
Do., Sttlmt. July	288	15	11 1/2
Aver. spot, July	288	16	3

SPELTER.

	£	s.	d.
Ordinary	28	10	0
Remelted	26	10	0
Hard	22	10	0
Electro 99.9	31	5	0
English	28	17	6
India	24	10	0
Zinc dust	37	0	0
Zinc ashes	10	10	0
Off. aver., July	28	3	0 1/2
Aver., spot, July	28	5	7

LEAD.

	£	s.	d.
Soft foreign ppt.	23	10	0
English	24	15	0
Off. average, July	23	14	2 1/2
Average spot, July	23	9	9 1/2

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	36	0	0
Do. V.M. ex whf.	34	10	0
Rods	42	0	0
Boiler plates	34	0	0
Battery plates	33	10	0

ANTIMONY.

	£	s.	d.
Special brands, Eng.	67	0	0
Chinese	52	0	0
Crude	37	0	0

QUICKSILVER.

	£	s.	d.
Quicksilver	21	15	0

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro-silicon—	
25%	£8 15 0
45/50%	£12 10 0
75%	£19 15 0
Ferro-vanadium—	
35/40%	£14/3 lb. va.
Ferro-molybdenum—	
70/75% c. free	5/- lb.
Ferro-titanium—	
23/25% carbonless	11 1/2d.
Ferro-phosphorus, 20/25%,	£17 15 0
Ferro-tungsten—	
80/85%, c. fr.	1/4 lb.
Tungsten metal powder—	
98/99%	1/8 1/2 lb.
Ferro-chrome	
2/4% car.	£33 15 0
4/6% car.	£23 15 0
6/8% car.	£23 0 0
8/10% car.	£22 12 6
Ferro-chrome—	
Max. 2% car.	£36 0 0
Max. 1% car.	£42 0 0
Max.0.70% car.	£54 0 0
70%, carbonless	1/5 lb.
Nickel—99%, cubes or pellets	£170
Ferro-cobalt	9/3 lb.
Aluminium 98/99%	£105
Metallic chromium—	
96/98%	3/3 lb.
Ferro-manganese (net)—	
76/80%, loose	£12 0 0
76/80%, packed	£13 0 0
76/80%, export	£11 15 0
Metallic manganese—	
94/96%, carbonless	1/10 lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten	s. d. 2 6
Finished bars, 18% tungsten	3 0

Per lb. net, d/d buyers' works.

Extras—

Rounds and squares 3 in. and over	4d. lb.
Rounds and squares under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to 1/16 in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅜ in.	3d. lb.
Do. under ½ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length 10% extra.

Scrap from high-speed tool steel—

Scrap pieces	3d.
Turnings and swarf	1d.

Per lb. net, d/d steel makers' works.

SCRAP.

	£	s.	d.		£	s.	d.
South Wales—				Lancashire—			
Hvy. steel	3 0 0	to	3 2 6	Cast-iron scrap	3 7 6		
Bundled steel & shrngs.	2 12 6	to	2 15 0	Hvy. wrought	3 2 6		
Mixed iron & steel	2 15 0			Steel turnings	2 2 6		
Heavy cast iron	3 1 0	to	3 2 6	London — Merchants' buying prices delivered yard.			
Good machinery for foundries	3 2 6	to	3 5 0	Copper (clean)	50 0 0		
Cleveland—				Brass (clean)	38 0 0		
Heavy steel	2 15 0	to	2 17 6	Lead (less usual draft)	21 0 0		
Steel turnings	2 4 0			Tea lead	18 0 0		
Cast iron borings	2 2 6			Zinc	18 0 0		
Heavy forge	3 12 6			New aluminium cuttings	80 0 0		
Bushelled scrap	3 2 6			Brazierv copper	45 0 0		
Cast-iron scrap	3 1 6	to	3 7 6	Gunmetal	47 0 0		
				Holiow pewter	170 0 0		
				Shaped black pewter	130 0 0		

PIG-IRON

(f.o.t. unless otherwise stated).

N.E. Coast—	
Foundry No. 1	72/6
Foundry No. 3	70/-
Foundry No. 4	69/-
Forge No. 4	68/6
Hematite No. 1	76/-
Hematite M/Nos.	75/6
N.W. Coast—	
Hem. M/Nos. d/d Glas.	85/-
,, d/d Birm.	93/9
Midlands—	
Staffs. common*	—
,, No. 4 forge	—
,, No. 3 fdry.	67/6
Shrops. basic	—
,, Cold blast, ord.*	—
,, ,, roll iron*	—
* d/d Birmingham.	
Northants forge	—
,, fdry. No. 3	62/6
Derbyshire forge	—
,, fdry. No. 3	67/6
,, basic	—
Scotland—	
Foundry No. 1	—
,, No. 3	76/6
Hem. M/Nos.	78/6
Sheffield (d/d district)—	
Derby forge	69/-
,, fdry. No. 3	71/6
Lincs. forge	—
,, fdry. No. 3	71/6
E.C. hematite	88/6
W.C. hematite	92/6
Lincs. (at furnaces)—	
Forge No. 4	—
Foundry No. 3	—
Basic	—
Lancashire (d/d eq. Man.)—	
Derby forge	—
,, fdry. No. 3	75/6
Northants foundry No. 3	—
Dalzell, No. 3	105/- to 109/-
Summerlee, No. 3	94/-to101/-
Glengarnock,No.3	94/-to101/-
Gartsherrie,No.3	94/- to 101/-
Monkland, No.3	94/- to 101/-
Coltness, No. 3	94/- to 101/-
Shotts, No. 3	94/- to 101/-

FINISHED IRON & STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£	s.	d.	£	s.	d.
Bars (cr.) nom.	9 15 0	to	11	0	0	
Angles				—		
Tees to 3 united ins.				—		
Nut and bolt iron				—		
Hoops				14	10	0
Marked bars (Staffs.) f.o.t.				13	10	0
Gas strip				12	10	0
Bolts and nuts ⅝ in. × 4 in.				15	5	0
Steel—						
Ship plates	8 2 6	to	8	7	6	
Boiler plts.				11	0	0
Chequer plts.				10	5	0
Angles				7	12	6
Tees				8	12	6
Joists				7	12	6
Rounds and squares 3 in. to 5½ ins.				7	15	0
Rounds under 3 in. to ⅜ in. (Untested)				8	0	0
				and upwards		
Flats, over 5 in. wide and up				9	2	6
Flats, 5in. to 1¼in.				8	2	6
Rails, heavy				8	2	6
Fishplates				12	10	0
Hoops (Staffs.)				10	10	0
Black sheets, 24g.				10	7	6
Galv. cor. shts, 24g.				14	0	0
Galv. fencing wire 8g. plain				12	10	0
Billets, soft	6 10 0	to	7	0	0	
Billets, hard				8	2	6
Sheet bars				5	15	0
Tin bars d/d				5	15	0

PHOSPHOR BRONZE.

	Per lb.	basis.
Strip	1	2 1/4
Sheet to 10 w.g.	1	2 1/4
Wire	1	3 1/4
Rods	1	2 3/4
Tubes	1	8
Castings	1	2

Delivery 3 cwt. free.

10% phos. cop. £40 above B.S.

15% phos. cop. £50 above B.S.

Phosphor tin (5%) £30 above price of English ingots.

C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	per lb.
Ingots for raising	9d. to 1/3
Rolled—	
To 9 in. wide	1/3 to 1/9
To 12 in. wide	1/3 1/2 to 1/9 1/2
To 15 in. wide	1/3 1/2 to 1/9 1/2
To 18 in. wide	1/4 to 1/10
To 21 in. wide	1/4 1/2 to 1/10 1/2
To 25 in. wide	1/5 to 1/11
Ingots for spoons and forks	9d. to 1/5 1/2
Ingots rolled to spoon size	1/- to 1/8 1/2
Wire round—	
3/0 to 10 G.	1/6 1/2 to 2/1 1/2

with extras according to gauge.

AMERICAN IRON & STEEL

At Pittsburgh unless otherwise stated.	Dols.
No. 2X foundry, Phila.	20.76
No. 2 foundry, Valley	18.00
No. 2 foundry, Birm.	17.25
Basic	20.75
Bessemer	20.26
Malleable	19.76
Grey forge	19.26
Ferro-mang. 80% d/d	90.00
Bess. rails, h'y, at mill	43.00
O.-h. rails, h'y at mill	43.00
Bess billets	33.00
O.-h. billets	33.00
O.-h. sheet bars	34.00
Wire rods	43.00
	Cents.
Iron bars, Phila.	2.12
Steel bars	1.80
Tank plates	1.80
Beams, etc.	1.80
Skelp, grooved steel	1.80
Skelp, sheared steel	1.80
Steel hoops	2.30
Sheets, black, No. 24	3.00
Sheets, galv., No. 24	3.85
Sheets, blue an'l'd, 9 & 10	2.25
Wire nails	2.55
Plain wire	2.40
Barbed wire, galv.	3.25
Tinplate, 100 lb. box	$5.50

COKE (at ovens).

Welsh foundry	—
,, furnace	—
Durham & North.	
,, foundry	—
,, furnace	15/-
Other Districts, foundry	—
,, ,, furnace (basis)	12/6

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. Cokes,	20 × 14, box	18/4 1/2
,,	28 × 20, ,,	36/9
,,	20 × 10, ,,	—
,,	18 1/4 × 14, ,,	—
C.W.	20 × 14, ,,	16/10 1/2
,,	28 × 20, ,,	—
,,	20 × 10, ,,	—
,,	18 1/4 × 14, ,,	—

Terneplates 28 × 20, — per box basis f.o.b.

SWEDISH IRON.

Bars,hammered	£18/10 to £19/0
Rolled Ord.	£15/5/0 to £15/15
Nail rods	£15 12 6 to £16 0 0
Keg. steel nom.	£33 to £35
Faggot steel nom.	£22 to £25
Blooms, according to quality	£8 to £12
Pig-iron	£6 0 0 to £6 10 0

all f.o.b. Gothenburg.

TUBES AND FITTINGS.

Up to and incl. 6 in.

	Tubes.	*Fittings*
Gas ..	67½% ..	45%
Water ..	62½% ..	40%
Steam ..	57½% ..	35%

W.I. 10% extra.

DAILY FLUCTUATIONS.

Standard Copper (Cash).

	£	s.	d.	
Aug. 4	56	7	6	dec. 1/3
,, 5	56	1	3	,, 6/3
,, 8	55	10	0	,, 11/3
,, 9	55	10	0	No change
,, 10	55	15	0	inc. 5/-

Electrolytic Copper.

	£	s.	d.	
Aug. 4	62	15	0	No change
,, 5	62	10	0	dec. 5/-
,, 8	62	0	0	,, 10/-
,, 9	62	0	0	No change
,, 10	62	15	0	inc. 15/-

Standard Tin (Cash).

	£	s.	d.	
Aug. 4	297	0	0	dec. 10/-
,, 5	299	10	0	inc. 50/-
,, 8	295	10	0	dec. 80/-
,, 9	296	5	0	inc. 15/-
,, 10	297	0	0	,, 15/-

Tin (English ingots).

	£	s.	d.	
Aug. 4	295	0	0	dec. 5/-
,, 5	297	10	0	inc. 50/-
,, 8	293	0	0	dec. 90/-
,, 9	293	15	0	inc. 15/-
,, 10	294	0	0	,, 5/-

Zinc Sheets (English).

	£	s.	d.	
Aug. 4	36	0	0	No change
,, 5	36	0	0	,, ,,
,, 8	36	0	0	,, ,,
,, 9	36	0	0	,, ,,
,, 10	36	0	0	,, ,,

Spelter (ordinary).

	£	s.	d.	
Aug. 4	29	5	0	dec. 2/6
,, 5	29	1	3	,, 3/9
,, 8	28	5	0	,, 16/3
,, 9	28	7	6	inc. 2/6
,, 10	28	10	0	,, 2/6

Lead (English).

	£	s.	d.	
Aug. 4	25	10	0	No change
,, 5	25	5	0	dec. 5/-
,, 8	24	10	0	,, 15/-
,, 9	24	10	0	No change
,, 10	24	15	0	inc. 5/-

BLAST-FURNACE STATISTICS.

Furnaces in Blast at the close of each Quarter making Pig-iron Specified.

Quarter ending.	Hematite.	Forge and foundry.	Basic.	Ferro-manganese	Total in blast.
1912					
March ..	16	26	7	6	55
June ..	103	163	47	12	325
September	113	170	49	15	347
December ..	115	171	49	15	350
1913					
March ..	118 2/3	169	52	18 1/3	358
June ..	117	163	50	14	344
September	107	157	47	13	324
December ..	91	154	55	13	293
1914					
March ..	96	146	47	11	300
June ..	90	143	45	12	290
September	94	133	41	15	286
December ..	100	136	46	12	294
1915					
March ..	102	130	52 2/3	10	294
June ..	103	126 1/3	54 2/3	10	294
September	105	117 1/3	52 2/3	11	287
December ..	108	111 1/3	50 2/3	15	284
1916					
March ..	116	106 1/3	50 2/3	12	285
June ..	120	106	54	13	293
September	124	107	58	13	302
December ..	126	110	57	18	311
1917					
March ..	131	111	62	16	320
June ..	129	116	70	15	324
September	123	102	78	19	322
December ..	118	99	85	13	315
1918	117	102	92	15	326
March ..	120	108	86	16	330
June ..					
September	120	104	83	14	321
December ..	113	108	72	15	308
1919					
March ..	98	109	69	13	289
June ..	97	107	78	7	289
September	66	99	53	5	223
December ..	77	113	62	8	260

Quarter ending.	Hematite.	Forge and foundry.	Basic.	Ferro-manganese	Total in blast.
1920					
March	92	108	72	10	282
June ..	97	119	68	12	296
September	93	122	73	12	300
December ..	77	125	59	13	274
1921					
March ..	36	70	10	3	119
June ..	—	1	—	—	1
September	17	41	10	—	68
December ..	22	41	15	3	81
1922					
March ..	31	46	23	7	107
June ..	25	55	28	9	117
September	27	74	27	10	138
December ..	46	83 1/3	30 2/3	10	170
1923					
March ..	52	93	45	10	200
June ..	62	103	45	13	223
September	38	98	42	11	189
December ..	50	99	49	9	207
1924					
March ..	45	94 2/3	51 1/3	10	201
June ..	45	91	46	8	190
September	44	85	38	5	172
December ..	42	87	31	7	167
1925					
March ..	40	84	36	9	169
June ..	31	76	32	9	148
September	28	67	30	5	130
December ..	38	74	32	4	148
1926					
March ..	39	79	33	4	155
June ..	3	5	4	2	14
September	1	4	—	—	5
December ..	24	33	20	2	79
1927					
March ..	50	86	39	7	182
June ..	46	86	36	10	178

WILLIAM JACKS & COMPANY,

WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

18, BENNETTS HILL, BIRMINGHAM.

18, BENNETTS HILL, BIRMINGHAM.
11, OLD HALL STREET, LIVERPOOL.
ROYAL BLDS., FISHER ST., SWANSEA.
FOWLERS BUILDINGS, BOMBAY.
CLIVE STREET, CALCUTTA.
20, SECOND LINE BEACH, MADRAS.
1, HONG KONG ROAD, SHANGHAI.

REGISTERED TRADE MARK

OCEAN BUILDING, SINGAPORE.
JAVA STREET, KUALA LUMPUR.
5, SHAFFRAZ ROAD, RANGOON
NADIR HOUSE, MACLEOD ROAD, KARACHI.
1 SHAREH SONK EL TEWFIKIEH, CAIRO.

PIG IRON

SCOTCH, MIDDLESBRO', HEMATITE, BASIC, SPECIALS, &c.,

NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE

WILLIAM JACKS & COMPANY,

19, ST. VINCENT PLACE, GLASGOW.

ZETLAND ROAD MIDDLESBROUGH.

SMALL ADVERTISEMENTS.

Notice.

Small Advertisements in this section of the Journal are accepted at the prepaid rate of 6d. per line, first line in capitals counting two, average 7 words per line. Minimum charge for one insertion 3/-.

(A remittance should accompany instructions.)

SITUATIONS VACANT AND WANTED.

CAPABLE young man (24), A.M.I.B.F., seeks situation as Assistant Manager, or similar; thorough training in foundry and general engineering; not afraid of hard work and responsibility; London district preferred.—Box 374, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

FOUNDRY MANAGER desires position; 25 years' practical and technical experience with largest firms in engineering; first-class references.—Address, Box 372, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

FOUNDRY FOREMAN (disengaged) requires situation; Iron, Bronze, Aluminium; modern experience; General and Repetition; initiative and energetic organiser; can get results; excellent references.—Box 332, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

YOUNG MAN (21), three years' foundry and two engineering experience, desires situation, preferably commercial.—Box 254, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

ASSISTANT FOREMAN MOULDER wanted in large Iron Foundry (South Midlands); must be progressive and thoroughly experienced in efficient and economical output of Light General Engineering Castings, also Machine Moulding; intimate knowledge of cupola practice essential; a good opportunity for an energetic man.—Write, giving full details, experience, age, salary, and names and addresses of last two employers, all correspondence treated in strict confidence, to Box 378, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

PROPERTY.

TO RADIATOR AND BOILER MAKERS, ENGINEERS, AND OTHERS.

Re T. H. PICKLES & SONS, LTD., MYTHOLMROYD.

FOR SALE, as a going concern, MODERN ENGINEERING WORKS, PLANT AND STOCK, Etc., of the above Company at EMPRESS FOUNDRY, MYTHOLMROYD, YORKSHIRE.

The Works comprise: Recently erected Foundry, 462 ft. x 56 ft.; Boiler and Machine Shop, 74 ft. x 40 ft.; Radiator Shop, 65 ft. x 34 ft.; Pattern Stores and Stock Room, 60 ft. x 23 ft.; office, large yard, vacant ground, etc.

The Premises are fitted with modern Electric Cranes, Cupola and all up-to-date appliances.

The Radiator, Boiler-making and Engineering Plant is all of recent date and capable of large turnover.

There is also valuable stock of Patterns, Radiators and Office Furniture.

For full particulars, apply Charles L. Townend, F.S.A.A., Receiver, Permanent Chambers, Halifax.

FOR SALE.

OLD-ESTABLISHED, IMPORTANT AND EXTENSIVE MALLEABLE AND CAST-IRON FOUNDRY BUSINESS,

ENGINEERING SHOPS AND LAND,

Formerly used by

J. CROWLEY & COMPANY, LIMITED, MEADOW HALL, SHEFFIELD.

RAILWAY SIDINGS TO L.M.S. & L.N.E. RAILWAYS.

AREA ABOUT 11 ACRES, FREEHOLD.

WORKS WELL SITUATED.

FLOOR SPACE, 145,000 FEET.

CENTURY OLD CONNECTION.

Full Particulars and Terms from

THOS W. WARD, LTD.,

ALBION WORKS, SHEFFIELD.

PROPERTY.—*Continued.*

FOUNDRY BUSINESS for Sale, by Private Tender, as a going concern, involving 500 tons iron castings per annum, to highest bidder for moulding boxes and patterns, with or without other equipment; Freehold Foundry Buildings near railway and tidal river, at present employed upon same, to be Let or Sold; near London.—Box 360, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

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INFORMATION HANDBOOKS, Advice, and Cons. free; King's Patent Agency, Ltd.—B. T. King, C.I.M.E. (Regd. Pat. Agent, G.B., U.S.A., and Can.), 146a, Queen Victoria Street, E.C.4. 40 years' refs. 'Phone: 0682 Central.

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